



## **2002** ACE PLAN Aviation Capacity Enhancement Plan

## BUILDING CAPACITY TODAY FOR THE SKIES OF TOMORROW

Federal Aviation Administration
Office of System Capacity

#### December 2002

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In 2002, the most important development affecting aviation activity was the gradual recovery of air traffic after the drop off that resulted from the events of September 11, 2001. At this time, the security and safety of the National Airspace System (NAS) are the immediate concerns of NAS providers and customers. However, the continued expansion of system capacity remains a priority to ensure that the NAS will be well positioned for the eventual recovery of traffic once our nation moves past these uncertain times.

The Aviation Capacity Enhancement (ACE) Plan is published annually by the Federal Aviation Administration's (FAA) Office of System Capacity. It contains a summary of the significant accomplishments of FAA-related programs, technologies, and initiatives affecting the capacity of the NAS. Airports, airlines and aviation organizations use the ACE Plan. Beyond the U.S. and international aviation industry stakeholders, academia and members of the U.S. Congress are also part of its audience.

#### Introduction – Perspectives on the NAS Recovery

Summarizes the events of the past year and the continuing changes in the NAS. Highlights the priorities of the Operational Evolution Plan (OEP). Provides a timeline of September 11, 2001.

### Chapter 1 – Aviation Activity and Capacity in the National Airspace System

Contains a summary of activity by all user groups during the past year and discusses the revised FAA forecasts for aviation activity to FY 2013. Also summarizes recent changes in demand for airport and air traffic services, including the increased use of regional jets and the introduction of new advanced aircraft.

#### Chapter 2 - National Airspace System Performance

Discusses new measures of the performance of the NAS. Summarizes recent delays and trends in delays.

#### Chapter 3 - Airport Capacity Analysis and Enhancements

Summarizes capacity analysis projects underway or recently completed. Reports on the demand management solutions in effect at some airports.

#### Chapter 4 - Airport Development

Provides an overview of new challenges to airport development and an update on airport construction projects and funding sources.

#### Chapter 5 - Operational Procedures

Provides an update on new and modified operational procedures. Topics include air traffic management during convective weather (the Spring/Summer Plan), reduced separation minima, the development of RNAV approaches, and simultaneous approaches to closely spaced parallel runways.

#### Chapter 6 - Airspace Redesign

Contains an update on FAA programs to redesign airspace and maximize efficiencies in air traffic flow. Reports on various elements of the National Airspace Redesign Plan, including high-altitude redesign and regional airspace redesign initiatives.

#### Chapter 7 - National Airspace System Modernization

Contains an overview of the FAA's air traffic control NAS modernization efforts.

These chapters are supported by additional information on aviation activity and construction projects at the busiest 100 U.S. airports in the following appendices:

#### Appendix A

Describes the basic elements of the National Airspace System.

#### Appendix B

Provides historical, current and forecast information on passenger enplanements and aircraft operations at the busiest 100 U.S. airports, as ranked by enplanements.

#### Appendix C

Summarizes the status of the recommendations of completed Capacity Enhancement Plans.

#### Appendix D

Summarizes runway construction projects that are proposed for 2007 and beyond.

#### Appendix E

Presents airport layouts with an update of current and proposed capacity enhancement projects.

#### Appendix F

Defines acronyms used in the ACE Plan.

#### Appendix G

Provides definitions of important aviation terms and concepts.

#### Appendix H

Lists the references used to prepare the ACE Plan and credits materials from FAA and other sources.

#### About the Data

The 2002 ACE Plan contains data for both calendar year (CY) 2001 and fiscal year (FY), October 1 – September 30, 2001. Since FAA forecasts are available only for fiscal years, all data relating to those forecasts are for fiscal years. Other data, such as delays, are presented for relevant calendar years. Appendices B and C provide comparative data for the last 3 fiscal and calendar years.

While the events of September 11 did negatively impact traffic in FY 2001, the greatest impact is expected to occur during the fourth quarter of calendar year 2001, which is also the first quarter of FY 2002. Normally these data comparisons vary only slightly. However, there will be relatively large differences between the fiscal and calendar year growth rates as reported in 2001 and 2002. Final analysis of this data will be released in 2003. This year, enplanements and operations for the individual airports contained in Appendix E are given for the most recent calendar year.



#### Perspectives On NAS Recovery

The nation's aviation priorities quickly moved from concerns about air traffic congestion and delays to implementing tighter security measures at airports following the events of September 11. Overall, air traffic has declined 2-3 percent during the past year. By mid-2002, the uneven resurgence in air travel brought the need for enhanced system capacity back into the limelight and efforts to increase system capacity must continue, since it is key to the long vitality of the aviation industry.

The ACE Plan is an annual synopsis of the FAA's efforts to help improve the efficiency of the aerospace system. The goal of these efforts is to increase the percentage of flights that arrive on time, improve airport capacity, and enhance the efficiency of the nation's aviation system.

#### The Cyclical Nature of the Industry

Air traffic continues to recover at an uneven pace as geography and national demographics redefine demand and accelerate the challenges to higher-demand air traffic flow regions. For example, traffic has recovered in the Midwest more quickly than it has on the East and West coasts. Furthermore, airlines are increasing the use of smaller aircraft such as regional jets, adding to an already complex air traffic management system.

The aviation industry historically adjusts to changing passenger traffic and freight demands by seeking to improve service and operating efficiency. In the past year their efforts include: readjustments of flight schedules, matching aircraft size to market demand, converting some mainline service to regional operators, increasing flight frequencies in key markets, cutting operational costs, and offering attractive price incentives. While flight operations at some airports are recovering at a faster rate than enplanements, airline revenues are expected to lag as the industry implements these strategies. Yet passenger traffic and the number of flights have been gradually increasing and the long-term forecast for the U.S. aviation industry is an upturn that will result in system-wide traffic returning to pre-September 11 levels in 2004. For this reason, it's critical that the focus of the aviation industry must include investments for long-term recovery.

During this temporary, economic downturn it's important to remember that the financial state of the airline industry will have an impact on the funding that is available for capital improvements in the aviation infrastructure. The tendency has been, and is, to delay some airport development projects; to put some on hold indefinitely; and to withdraw airline financial support from some projects. Therefore, it is essential to understand that the capacity of the national airspace system remains a key component to the long-term vitality of the U.S. economy. The FAA is committed to supporting construction of new runways and other airfield improvements that will be needed when air traffic levels recover. Through the provisions of airport grants and Passenger Facility Charge (PFC) approvals, procedure development, and equipment modernization, the FAA is working with the industry to ensure that the aviation system capacity keeps pace with air travel demand. The following figure provides a historical perspective of air traffic recovery following political and economic shocks over the past 40 years.

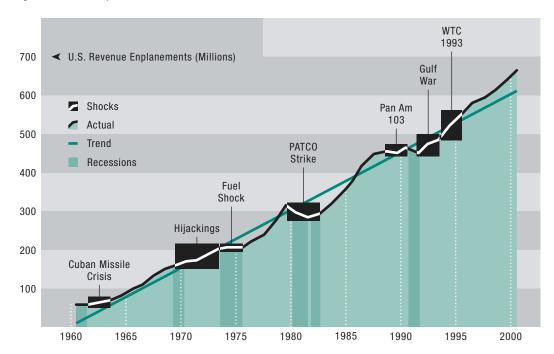


Figure I-1 Aviation System Shocks and Recoveries

"The 60's led with the Cuban Missile Crisis while the 70's introduced aircraft hijackings with subsequent effects on international aviation demand in particular. The 80's opened with the PATCO strike, while the Persian Gulf War created temporary travel uncertainty in the early 90's. The new millennium brings us a new war against worldwide terrorism that presents a unique set of uncertainties."

#### **Event And Recovery Timelines**

Prior to September 11, 2001, the NAS handled 1.9 million passengers, traveling on 60 thousand flights, daily. On that day—the skillful actions of the FAA's air traffic controllers, working in unison with airline, military, and government personnel, safely landed 4,500 aircraft carrying 350,000 passengers and crew in a period of approximately one and a half hours. More than 1,100 flights were rerouted in the first 15 minutes after the order to land was issued—more than one aircraft every second. The events of this day continue to have a rippling effect on air traffic demand in the NAS. The following timeline summarizes the sequence of events on September 11 to shutdown the air traffic system, followed by the key milestones of air traffic system recovery.

<sup>1</sup> Aviation System Shocks and Recoveries: "History favors optimism, opportunities in light of tragic events," by James G. Walsh, Landrum & Brown, for ATA.



#### September 11, 2001

Chronology of Events on September 11, 2001

#### 0800.

American Airlines Flight 11, a Boeing 767 with 92 people on board, takes off from Boston Logan Airport for Los Angeles.

#### 0814.

United Airlines Flight 175, a Boeing 767 with 65 people on board, takes off from Boston Logan airport for Los Angeles.

#### 0821.

American Airlines Flight 77, a Boeing 757 with 64 people on board, takes off from Washington Dulles airport for Los Angeles.

#### 0840.

FAA notifies the North American Aerospace Defense Command's (NORAD) Northeast Air Defense Sector about the suspected hijacking of American Flight 11.

#### 0841.

United Airlines Flight 93, a Boeing 757 with 44 people on board, takes off from Newark airport for San Francisco.

#### 0843.

FAA notifies NORAD's Northeast Air Defense sector about the suspected hijacking of United Flight 175.

#### 0846.

Approximately. American Flight 11 crashes into the north tower of the World Trade Center.

#### 0902

Approximately. United Flight 175 crashes into the south tower of the World Trade Center.

#### 0904.

Approximately. The FAA's Boston Air Route Traffic Control Center stops all departures from airports in its jurisdiction (New England and eastern New York State).

#### 0906.

The FAA bans takeoffs of all flights bound to or through airspace of New York Center from airports in that Center and three adjacent Centers—Boston, Cleveland and Washington. This is referred to as a First Tier ground stop and covers the Northeast from North Carolina north and as far as west as eastern Michigan.

#### 0908.

The FAA bans all takeoffs nationwide for flights going to or through New York Center airspace.

#### 0924.

The FAA notifies NORAD's Northeast Air Defense Sector about the suspected hijacking of American Flight 77. The FAA and NORAD establish an open line to discuss American 77 and United 93.

#### 0926.

The FAA bans takeoffs of all civilian aircraft regardless of destination—a national ground stop.

#### 0940.

Approximately. American Flight 77 crashes into the Pentagon.

#### 0945.

In the first unplanned shutdown of U.S. airspace, the FAA orders all aircraft to land at the nearest airport as soon as practical. At this time, there were more than 4,500 aircraft on Instrument Flight Rules (IFR) flight plans.

#### 1007.

Approximately. United Flight 93 crashes in Stony Creek Township, PA.

#### 1039.

Reaffirming an earlier order, the FAA issues a Notice to Airmen (NOTAM) that halts takeoffs and landings at all airports.

#### 1215.

Approximately. The airspace over the 48 contiguous states is clear of all commercial and private flights.

#### Notes:

All times is Eastern Daylight. For UTC/Zulu/GMT, add four hours.

Flight departures are actual takeoff times, not scheduled or gate departure times.<sup>2</sup>

#### September 13

Most U.S. airports reopen after meeting new security requirements, Boston and Reagan National remain closed and general aviation activity is limited.

#### September 14

General Aviation Instrument Flight Rule (IFR) flights are allowed with restrictions, but cannot operate within 25 nautical miles of DCA or JFK.

#### September 15

Boston reopens.

<sup>2</sup> Federal Aviation Administration August 12, 2002 press release "Chronology of Events on September 11, 2001."

#### September 19

Limited return of general aviation, for Part 91 Visual Flight Rule (VFR) flights within Enhanced Class B airspace, which is the area within 40 to 50 miles of the nations most heavily, used airports.

#### October 1

The Federal Aviation Administration steps in and issues 80 war risk insurance policies to carriers on a temporary basis when commercial insurance markets cancel coverage.

#### October 4

Washington Reagan National Airport reopens to limited commercial air service, and no general aviation traffic is allowed.

#### November 19

President Bush signs the Aviation and Transportation Security Act, which establishes a new agency to handle airport security, the Transportation Security Administration (TSA).

#### February 17, 2002

Responsibility for airport security was transferred from U.S. airlines to the federal government, which includes responsibilities for screening luggage and passengers, as well as hiring permanent staff to facilitate new security measures.

#### April 24

Reagan National now operates with most restrictions lifted, while general aviation traffic is still prohibited.

#### September 11

The US National Airspace System carries 188,873 operations, compared to 36,340 operations when the airspace was shut down on September 11, 2001.

### Operational Evolution Plan (OEP): Achievements, Planning Adjustments and Communications Progress

The OEP is a detailed 10-year plan for more than 100 separate programs to support modernization and increase the capacity and efficiency of the national airspace system while maintaining safety and security. The OEP is periodically modified to reflect new innovations and emerging technologies that could improve the movement of air traffic, and/or increase NAS capacity. The airlines, airports and other members of the aviation community shared in the development of the OEP and continue to play an active role in its evolution. As demand continues to return, the OEP stays its course to build an aviation system for the 21st century that is responsive to adjusted forecasts of demand. At the same time, the OEP is also taking into account the current economic climate and working with aviation community stakeholders to better plan investment decisions, solve problems and advance new technologies. Solutions are being proposed in four critical areas: Arrival and Departure Rates, En Route Congestion, Airport Weather, and En Route Severe Weather. Important OEP initiatives include:

- ➤ The plans for new runways at 12 airports, which will provide a significant increase in capacity.
- > Support from the users, who must make significant investments in avionics equipment and pilot training to take advantage of the implementation of new technologies.
- ➤ Efforts by the FAA, working with National Aeronautics and Space Administration (NASA) and the Department of Defense (DoD), to undertake research and development of new air traffic management technologies, advanced air traffic control support tools, improved training efficiency and enhanced safety through human factors research.

#### Overview of the OEP Quadrants

#### Arrival and Departure Rates

There are two strategies to help airports meet peak demand: constructing new runways dramatically increase the capacity of any airport but may take up to 10 years to build; maximizing the use of existing runways—allowing new operations, introducing new technologies, or improving airspace design, surface management, air traffic procedures, standards, workload, information exchange and decision support tools.

#### En Route Congestion

In the en route arena, capacity and efficiency are governed by sectors, separation standards and controller workload. To meet peak demand, capacity can be enhanced in short cycles (adding controllers to sectors, changing the size of sectors) and long cycles (establishing new sectors and new routes). En route congestion quickly ripples into other airspace creating delay for many flights. En route success assures flexibility operations.

#### Airport Weather

For the benchmark airports, typical bad weather operations lower arrival and departure rates 18 percent compared to good weather. As weather or visibility degrades, runway use may become limited and spacing between aircraft grows. To make airport operations less sensitive to weather, we need more options for runway configurations and more consistent spacing of operations, much of which requires new technologies.

#### En Route Severe Weather

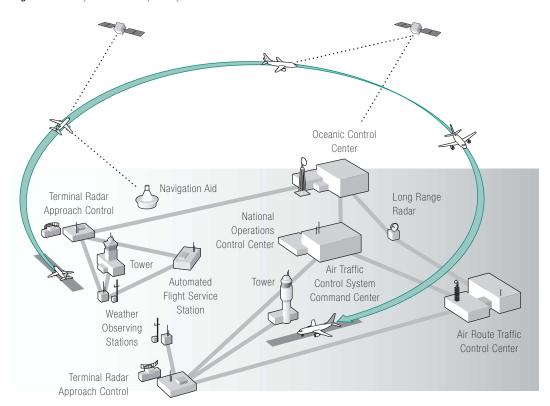
Almost half of our delays and cancellations arise in bad weather, reactions to that weather or the congestion it causes. Improvements will come from improved forecasting, improved sharing of real-time data, and quicker re-configuration of airports, before, during or after severe weather.

Version 5.0 of the NAS Operational Evolution Plan may be accessed on the FAA's Web site, at http://www.faa.gov/programs/oep.

#### 2002—A New Era In Aviation Begins

The cover of this year's ACE Plan symbolizes recovery, both the return of air traffic and the renewed confidence of the nation's air travelers. The photographs represent a passenger's experience in traveling through a U.S. airport, depicted in green for economic revitalization, in blue for the vital role of air traffic controllers and pilots governing the skies, and yellow, for the dawn of the new era in aviation. It's been said that jet fuel powers the nation's economic engine. While the faltering economy and events of 2001 caused a staggering stall, indications are that the engine is "re-powering." We look towards a future of recovery and new heights of achievement as we acknowledge the accomplishments from a Centennial of Flight, which will be celebrated in 2003. The following illustration represents the efficient, integrated operations of the National Airspace System.

Figure I-2 Today's National Airspace System

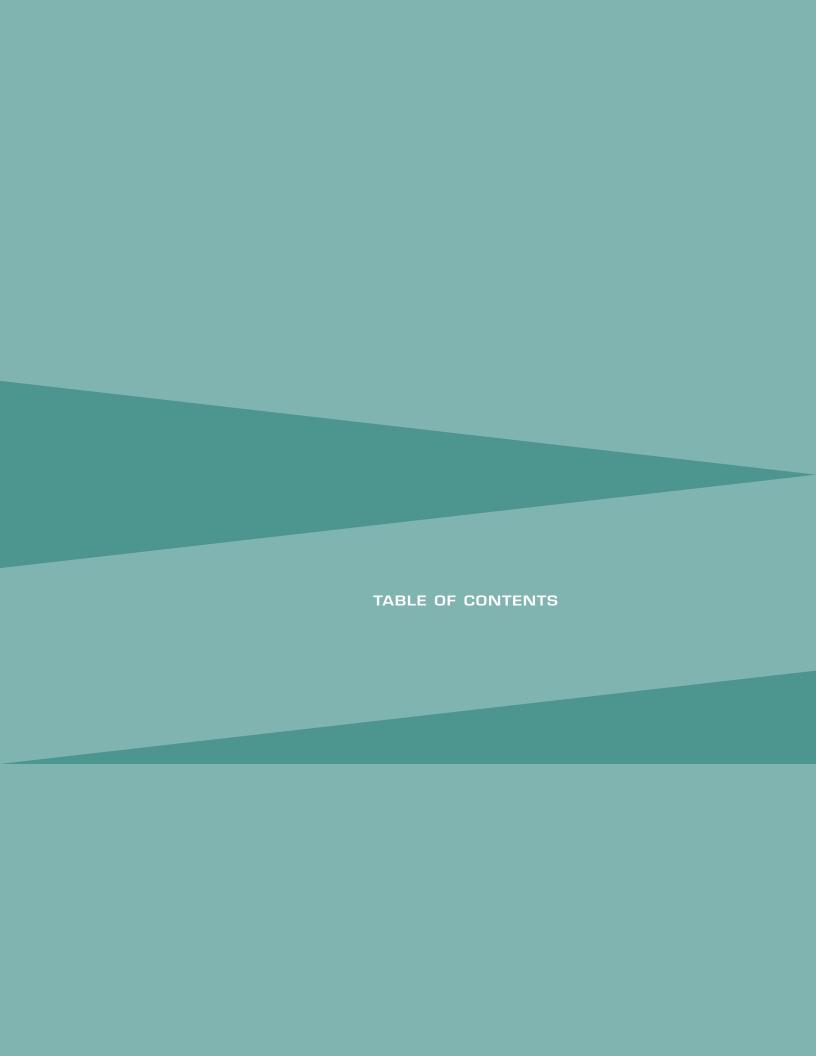


The ACE Plan highlights capacity-related annual accomplishments and performance data of the National Airspace System. The OEP is the 10-year tactical implementation effort that supports the short-, mid- and long-term operations, reflecting the continued collaboration among the FAA, airlines, airports and other major components of the aviation industry. The longer-term outlook is also part of the FAA's perspective, to provide a safe and efficiently operating NAS, able to accommodate increasing air traffic demand without excessive delays.

#### The Vision

In the future airspace system, reflecting the vision for 2020 and beyond, air travel will be far more reliable and flexible than it is today. At the core of the future airspace system are state-of-the art decision support tools that improve situation awareness in all aspects of flight. As for the future vision of the infrastructure, airports will have new capabilities as well. Along with new runways at the most constrained locations, more airports will be equipped to handle more air traffic in more difficult kinds of weather, removing the restrictions of predefined route structures. Improved operations at parallel runways, even in degraded weather, and improved procedures at airports without new runways, are also essential to capacity growth.<sup>3</sup>

<sup>3</sup> Future Concept of Operations, published by the RTCA, www.jupiteralignedwithmars.com



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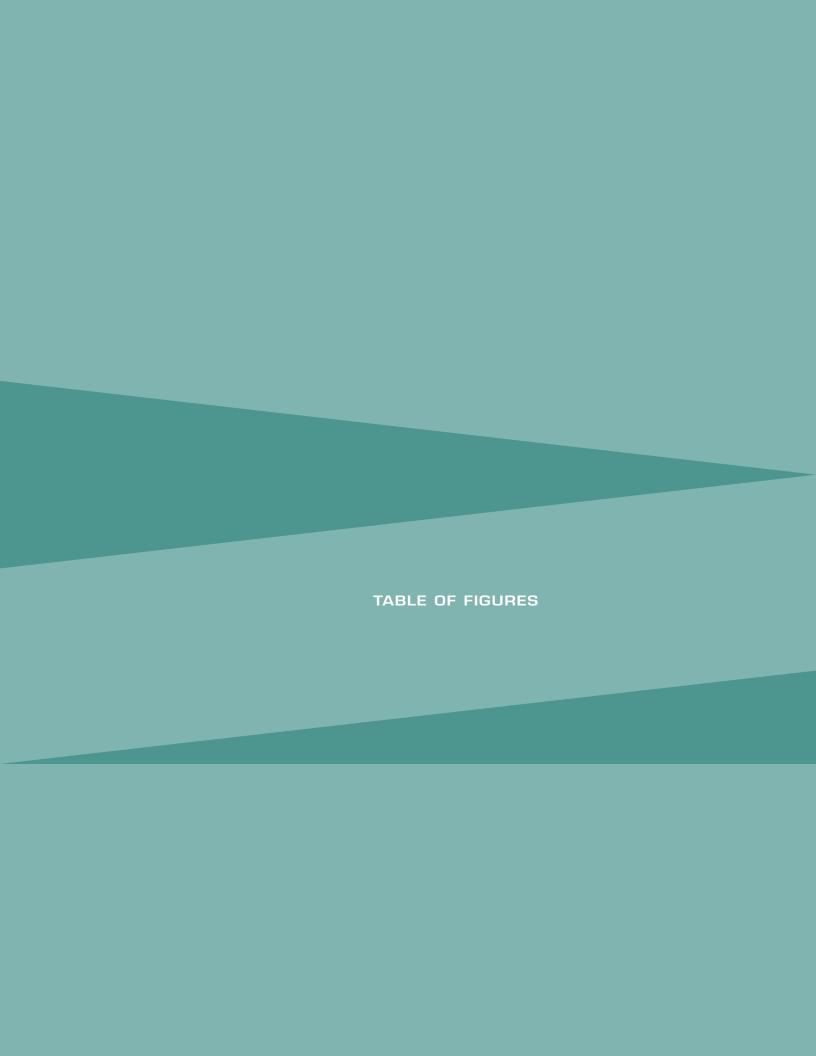


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#### 1 Aviation Activity and Capacity in the National Airspace System

The National Airspace System (NAS) has several different types of traffic, including commercial passenger and cargo traffic, general aviation traffic, and military operations. Each is an important part of the activity in the NAS and places different demands on the air traffic control system. This chapter summarizes trends in aviation activity and discusses FAA forecasts to FY 2013.

#### 1.1 Activity and Capacity

Aviation activity is a reflection of the demand on airports and the air traffic control system. The FAA measures activity primarily in terms of passenger enplanements and aircraft operations. Capacity is an expression of the system's ability to accommodate the demand, which the airlines and the FAA measure differently. The airlines measure the capacity they provide in terms of meeting the needs of their customers, passengers and shippers. They track summary statistics such as available seat miles for passengers and available ton-miles for shippers. The FAA has traditionally measured capacity indirectly by tracking flight delays. Delay is an indicator that capacity is temporarily (or chronically) insufficient. In recent years, the FAA has improved its measures of capacity through the airport benchmark project and the development of additional measures, such as airport efficiency rates.

#### 1.2 Aviation Activity in the United States

Aviation activity is generated by a number of diverse participants: large commercial air carriers, regional carriers, commuter airlines, on-demand air taxis, all-cargo airlines, the military and general aviation operators. Each user group places different demands on the airports and the air traffic control system, because the magnitude, the location, and the timing of their activities vary. All commercial activity is conducted under the control of the FAA's air traffic control system, whether the operators are large commercial jets, regional jets, cargo carriers, commuters, or air taxis. In contrast, the majority of general aviation activity takes place at small airports far from major urban centers and may have little or no contact with the air traffic control system. Much of the contact that general aviation pilots do have is with the specialists at flight service stations rather than with air traffic controllers. However, general aviation does have a significant impact at some major airports, as noted below (see section 1.2.4). Military airports support most of the military traffic and the military's own air traffic control system handles most of their terminal operations.

#### 1.2.1 Enplanements and Operations at U.S. Airports

In FY 2001, passenger enplanements decreased slightly from the previous year, from 695.7 million to 682.5 million (13.2 million or 1.8 percent fewer), marking the first annual decline in enplanements since the Gulf War in 1990. The economy was weakening before the events of September 11, but through August enplanements were running near those of the previous year. The temporary shutdown of the NAS and the sharp drop in traffic after September 11 resulted in a decline for the entire year. Enplanements for September 2001 were approximately 34.2 million, 19.9 million (or 38 percent) less than the 52.1 million of September 2000.

Every year, the FAA prepares a 12-year forecast of aviation activity and presents it at the FAA Aerospace Forecasts in March. Figure 1-1 compares the March 2002 forecast for

passenger enplanements to the March 2001 forecast. Although the FAA's new forecast shows steady growth resuming in FY 2003, it does not project enplanements reaching the previous forecast for FY 2002 (about 740 million) until FY 2005, a delay of 3 years; similarly, the new forecast postpones reaching the 1 billion level by 3 years, from FY 2010 to FY 2013. The gap between the lines shows the long-term impact of September 11, which translates into lost revenue for the airlines (through tickets sold), the aviation trust fund (through excise taxes) and the airports (through PFCs).

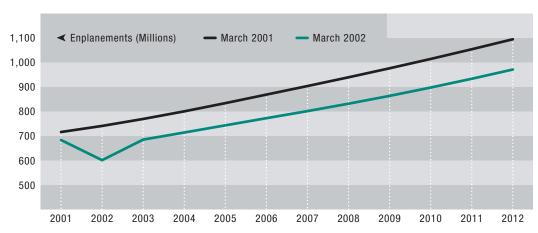


Figure 1-1 FAA Forecasts of Passenger Enplanements, March 2002 vs. March 2001

Source: FAA Aerospace Forecasts March 2001 and March 2002

The FAA tracks aircraft operations (take-offs plus landings) for four classes of users: air carriers, air taxis/commuters, general aviation operators, and the military. Of these, only air carriers and air taxis/commuters generate any passenger enplanements, but general aviation accounts for the largest number of operations. Figure 1-2 shows the distribution of aircraft operations by user group for FY 2001.

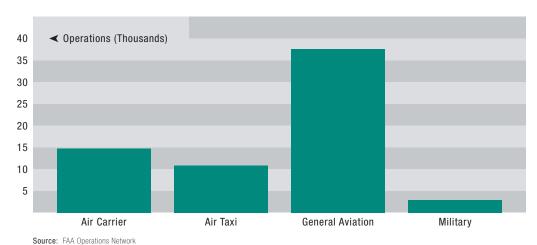


Figure 1-2 Aircraft Operations by User Group for FY 2001

Aircraft operations for all users declined by 3.6 percent in FY 2001, going from 68.7 million to 66.2 million operations, compared to an earlier forecast for an increase to 71.0 million. However, the rate of change for the four user groups varied significantly: air carrier operations decreased by 2.6 percent and air taxi/commuter operations increased by 1.1 percent, while general aviation operations decreased by 5.7 percent and military operations increased by 0.9 percent. As with enplanements, the real impact of September 11 was only partially shown in FY 2001. For the month of September 2001 the number of operations was only 4.2 million, compared to the previous year's 5.8 million operations. Total operations decreased from 67.7 million in 2000 to 65.5 million in FY 2001.

The FAA forecasts aircraft operations to increase significantly by 2013, reaching 81.7 million for all users, an increase of 23.5 percent over the 2001 level. But as with passenger enplanements, the forecast was adjusted downward after September 11. The current forecast calls for a decrease in operations for FY 2002 (from 66.2 million to 64.4 million) and a resumption of growth thereafter.

The decrease in the projected number of aircraft operations in the near-term and the lower forecasts for the longer term varies by user group. The decreases are significant and long lasting for air carriers and general aviation, but air taxis/commuters and the military actually show slight increases in operations.

#### 1.2.2 Enplanements and Operations at the Busiest U.S. Airports

Because of the concentration of commercial traffic at the largest airports and the dispersion of general aviation operations, the 100 busiest airports, as ranked by passenger enplanements, accounted for more than 96 percent of passenger enplanements but only 42 percent of aircraft operations in FY 2001.

Passenger enplanements for the 100 busiest airports (ranked by CY 2000 enplanements), by both fiscal and calendar year for the past 3 years are shown in Appendix B-1. The FAA forecasts and rates of growth for these same airports for FY 2013 are presented in Appendix B-2.

Aircraft operations for all user groups for the same 100 airports (ranked by CY 2000 enplanements), by both fiscal and calendar year for the past 3 years are shown in Appendix B-3. The FAA forecast and rates of growth for those airports for FY 2013 are presented in Appendix B-4.

#### 1.2.3 Air Cargo Activity

Cargo traffic, like all other aviation activity, has been depressed by both the aftermath of the September 11 and the economic downturn. However, recent reports suggest a significant year-over-year recovery in air cargo volumes, indicating that the slump may be ending and that more normal growth will resume. Air cargo volume is often considered to be a leading indicator of economic growth.

The summary data for cargo activity collected by the DOT and published by the FAA are in terms of revenue ton-miles (RTMs), or one ton of cargo flown for one mile. For FY 2001, total cargo activity was approximately 28.5 billion RTMs, a decline of 3.3 percent from 30.1 billion in FY 2000. Cargo is carried aboard passenger aircraft and all-cargo aircraft. In FY 2001, passenger carriers flew 11.1 billion RTMs (39 percent) and all-cargo airlines flew 17.4 billion RTMs (61 percent). Total cargo traffic as measured in RTMs, is

dominated by the two large all cargo airlines, FedEx, with 26 percent of the market, and United Parcel Service (UPS), with 15 percent of the market.

Cargo traffic at individual airports is measured in tons loaded and unloaded. Not surprisingly, the airports where FedEx and UPS have hubs for their overnight package service are among the busiest cargo airports. Memphis, the main base for FedEx, was the busiest cargo airport in CY 2001 and Louisville, the main hub for UPS, was the fifth busiest cargo airport. The ten busiest cargo airports and the change in the tonnage loaded and unloaded in CY 2001 are shown in figure 1-3 below.

Figure 1-3 Busiest Cargo Airports for CY 2001

Airport (ID)	Metric Tons	Change from CY 2000
Memphis International (MEM)	2,631,631	5.7%
Ted Stevens Anchorage International (ANC)	1,873,750	3.9%
Los Angeles International (LAX)	1,774,402	(13.0%)
Miami International (MIA)	1,639,760	0.0%
Louisville International (SDF)	1,469,837	(3.2%)
New York John F. Kennedy International (JFK)	1,430,727	(21.3%)
Chicago O'Hare International (ORD)	1,299,628	(11.5%)
Indianapolis International (IND)	1,115,272	(4.3%)
Newark Liberty International (EWR)	795,584	(26.4%)
Dallas-Fort Worth International (DFW)	784,085	(13.4%)

Source: Airports Council International-North America

#### 1.2.4 General Aviation Activity

General aviation (GA) includes all segments of civil aviation except commercial air carriers (air carriers, commuters, air taxis, charters, and unscheduled traffic). The majority of U.S. airports handle only GA traffic. Many of these are small, rural airports without an air traffic control tower. Flights to and from these airports typically have little or no contact with the FAA's air traffic control system and don't contribute to airport or airspace congestion. Nonetheless, in FY 2001, almost 30 million GA operations took place at airports with air traffic control towers, over 10 percent of total aircraft operations at those airports. Handling a mix of air carrier and GA aircraft operations requires controllers to carefully segregate aircraft types to accommodate different aircraft speeds and to avoid wake vortex incidents.

General aviation operations have been severely affected by the events of September 11, but the impact has been very uneven. In fact, for both fiscal and calendar year, total GA operations were only slightly down. However, operations at the busier commercial aviation airports were down significantly because of the restrictions placed on GA after September 11. Perhaps the most significant restriction is the total ban of all general aviation operations at Reagan Washington National Airport. Before September 11, DCA averaged about 5,000 GA operations per month, some 17.5 percent of all operations. Figure 1-4 lists the airports with the largest number of general aviation operations. Six of these airports are primary commercial service airports, while four are relievers.

Figure 1-4 Busiest General Aviation Airports for FY 2001

Airport (ID)	City/State	Airport Type	Operations
Van Nuys (VNY)	Van Nuys, CA	Reliever	433,590
Orlando-Sanford International (SFB)	Orlando, FL	Primary	385,247
Daytona Beach International (DAB)	Daytona Beach, FL	Primary	362,506
Long Beach-Daugherty Field (LGB)	Long Beach, CA	Primary	344,937
Phoenix-Deer Valley Municipal (DVT)	Phoenix, AZ	Reliever	332,400
Denver Centennial (APA)	Denver, CO	Primary	327,309
E.A. Love Field (PRC)	Prescott, AZ	Primary	313,109
John Wayne-Orange County (SNA)	Santa Ana, CA	Primary	284,343
Oakland-Pontiac (PTK)	Pontiac, MI	Reliever	283,763
Boeing Field-King County International (BFI)	Seattle, WA	Reliever	269,106

Source: FAA Operations Network

General aviation also has a significant presence at the busiest commercial service airports. GA traffic accounted for 8.2 percent of total aircraft operations at the 31 large-hub airports in FY 2001. As shown in Figure 1-5, the actual percentage of GA operations varied from just 1.2 percent at Seattle-Tacoma to 27.4 percent at Ft. Lauderdale.

Figure 1-5 GA Operations at the Large-Hub Airports for FY 2001

Airport (ID)	General Aviation Operations	Total Operations	% General Aviation Operations
Ft. Lauderdale-Hollywood International (FLL)	81,993	299,773	27.4%
Honolulu International (HNL)	85,185	339,987	25.1%
Minneapolis-St. Paul International (MSP)	125,483	512,102	24.5%
Chicago-Midway (MDW)	58,026	280,527	20.7%
Salt Lake City International (SLC)	72,860	363,682	20.0%
Las Vegas McCarran International (LAS)	80,377	513,679	15.6%
Miami International (MIA)	68,631	489,058	14.0%
Washington Dulles International (IAD)	57,692	430,082	13.4%
Philadelphia International (PHL)	60,966	475,577	12.8%
Charlotte-Douglas International (CLT)	48,151	471,731	10.2%
Phoenix Sky Harbor International (PHX)	63,921	627,561	10.2%
Detroit Metropolitan Wayne County (DTW)	51,618	540,966	9.5%
Baltimore-Washington International (BWI)	26,992	328,428	8.2%
Orlando International (MCO)	26,686	343,457	7.8%
Greater Cincinnati International (CVG)	28,032	390,306	7.2%
San Diego International Lindberg Field (SAN)	13,960	213,080	6.6%
George Bush International (IAH)	25,331	489,987	5.2%
Boston Logan International (BOS)	25,262	499,474	5.1%
Greater Pittsburgh International (PIT)	22,169	452,696	4.9%
San Francisco International (SFO)	19,858	407,040	4.9%
Lambert St. Louis International (STL)	20,949	486,503	4.3%
Newark Liberty International (EWR)	16,437	462,202	3.6%
Denver International (DEN)	14,512	526,204	2.8%

Figure 1-5 Continued

Airport (ID)	General Aviation Operations	Total Operations	% General Aviation Operations
New York LaGuardia (LGA)	10,797	404,206	2.7%
Chicago O'Hare International (ORD)	24,496	927,896	2.6%
New York John F. Kennedy International (JFK)	8,156	340,459	2.4%
Los Angeles International (LAX)	17,259	783,160	2.2%
Dallas-Fort Worth International (DFW)	13,144	835,748	1.6%
Hartsfield Atlanta International (ATL)	13,558	898,899	1.5%
Seattle-Tacoma International (SEA)	5,110	423,903	1.2%
Total Large-Hub Airports	1,212,003	14,863,673	8.2%

Source: FAA Operations Network

#### 1.2.5 Military Operations

Military operations account for a small fraction of the activity at the nation's commercial airports, but a significant amount of U.S. airspace is designated as special use airspace reserved for military operations. Special use airspace is available to commercial or GA operations only when the military opens a particular airspace area to non-military operations for a specified time period. Special use airspace and procedures for sharing that airspace are discussed in greater detail in Chapter Six and Appendix A. Following September 11, the deployment of military aircraft in civilian airspace has increased, as patrols have been instituted to provide greater security.

#### 1.3 Other Sources of Commercial Aviation Activity

Additional sources of commercial aviation activity may have a significant long-term impact of the demand for airport and airspace capacity. The most important of these trends is the continuing growth in the use of regional jets to replace both mainline jets (primarily operated by large commercial carriers) and turboprops (primarily operated by regional airlines), which affects the mix of aircraft at airports and in en route and terminal airspace. The large aircraft manufacturers, Airbus and Boeing, although cutting production of current models this year, are continuing development of new models.

#### 1.3.1 Regional Jets

Regional jets (RJs) are turbo-fan-powered airplanes, generally seating 70 or fewer passengers, with certain models seating up to 100 passengers. Operationally, regional jets are positioned between large turboprops, such as the Saab 340 and the Bombardier Dash-8, and narrow body mainline jets, such as the B-737 and the MD-80.

The replacement of turboprops has been a consistent trend over the years because of travelers' preference for jets. Recently, RJs have been replacing mainline jets on some routes as airlines have tried to adjust capacity in a period of declining traffic. The ability of regional jets to replace both turboprops and mainline jets has enabled them to maintain a strong market position in spite of the downturn in commercial aviation since September 11.

Over the past decade, the regional jet market has grown impressively. In 1991, three regional airlines operated fewer than 20 RJs. By 2001, 15 regional airlines operated 666

regional jets. In that same period, the number of regional jet departures grew from a little more than 9,100 (less than one percent of industry operations) to over 1.2 million in 2001 (32 percent).

Most aviation analysts, and the FAA, expect the size of the regional jet fleet, the number of regional jet operations, and the number of airports they serve to grow rapidly. In FY 2001, the commuter/regional airlines enplaned 80 million passengers. The FAA projects their system-wide enplanements (which includes both turboprop and jet operations) to increase at an average annual rate of 5.5 percent through FY 2013.

Most of the carriers' growth will come from an increase in the use of regional jets. The proportion of the carriers' traffic provided by regional jets continues to increase as they replace turboprops with regional jets and as larger regional jets, with seating capacity exceeding 70, are introduced. The increased use of regional jets is also expected to increase the average seating capacity of the regional fleet and the average passenger trip length for these carriers. The FAA forecasts that the number of regional jets in service will increase from 2,427 in FY 2001 to 4,457 in FY 2013.

The continuing increase in the number of RJs may ultimately have a negative impact on air traffic flow and operations because of the increased volume on jet routes to/from airports and at higher en route altitudes. At the same time, certain airports that have built runways for turboprop aircraft may find those facilities underused.

#### 1.3.2 New Transport Aircraft

Each of the major aircraft manufacturers has its own proposal for a radically new aircraft, the A380, a new large aircraft (NLA) for Airbus and the sonic cruiser for Boeing. Each manufacturer's aircraft plan is based on a different outlook for the future of the industry. Airbus anticipates there will be a need for a much larger aircraft that will serve to connect busy and congested hubs, where landing slots will be at a premium. Boeing, while conceding the demand for a small number of such very large aircraft, projects a greater demand for point-to-point service, especially in long distance markets. However Boeing is re-evaluating which model of aircraft will be more successful in meeting that demand.

Whatever the long-term outcome is, none of these aircraft will be put into operation for several years and then only a few aircraft at a time. The first passenger version of the A380 is scheduled for delivery in 2006, followed by a freighter, the A380F, in 2008. Boeing has not yet committed to the production of the sonic cruiser and recently has begun considering applying much of the sonic cruiser's new technology to a fuel-efficient conventional jet.

The A380 will seat 555 passengers in its original configuration, while the A380F will be capable of carrying 330,000 pounds of cargo. Airbus has approximately 95 firm orders for the two aircraft to date. Fourteen U.S. airports expect to provide A380/A380F service by 2010.4

In February 2002, the General Accounting Office published its survey of those airports' estimates of the costs of the modifications required to serve the A380/A380F. The 14 airports collectively estimated that it would cost more than \$2 billion to make the

<sup>4</sup> The 14 airports are Los Angeles, Chicago O'Hare, New York Kennedy, Anchorage, San Francisco, Dallas-Fort Worth, Indianapolis, Washington Dulles, Memphis, Atlanta, Houston Intercontinental, Orlando, Miami, and Denver.

required modifications. Airbus responded that many of the airports' estimates were high because of rough and inconsistent analyses and the inclusion of certain costs that are not NLA-specific. Airbus estimated that the required changes would cost only some \$520 million. An unresolved issue that contributes to the variation in the cost estimates is whether, and under what conditions, operational modifications such as restricting the NLA to certain taxiways could be employed to avoid large expenditures on airport upgrades.

The FAA's New Large Aircraft Facilitation Group, which is composed of representatives from the FAA, aircraft manufacturers, airports, and various aviation industry associations, has been active in assessing the potential impact of the A380 or other large aircraft. Its work has included evaluations of the structural and/or operational modifications that might be required to accommodate these aircraft at U.S. airports and working with the International Civil Aviation Organization to ensure the development of harmonious standards.

In addition to the work of the NLA Facilitation Group, the Office of System Capacity recently conducted a ground movement analysis at Memphis International Airport to determine whether the operation of an NLA would adversely impact the operation of other aircraft at that airport. The study found that there would be no significant impact. A similar study is being conducted at Kennedy International Airport.



# CHAPTER 2 NATIONAL AIRSPACE SYSTEM PERFORMANCE

#### 2 National Airspace System Performance

The Chief Financial Officers' Act of 1990 requires the systematic measurement of performance and the Government Performance Results Act of 1993 (GPRA) holds agencies accountable for achieving specific results. During the past 6 years, the Department of Transportation's Performance Plan developed a series of measures for FAA programs and results, which were supported and augmented by additional metrics in the FAA Performance Plan and the Air Traffic Services Performance Plan. The FAA has increased its emphasis on measuring how well it is meeting the expectations of its customers and managers, based on direction from the Congress that the FAA be operated as a performance-based organization.

#### 2.1 System Performance and Performance Goals

A key to the transformation of the FAA into a performance-based organization is the development of a series of metrics by which the performance of the agency can be measured. Some of these proposed metrics have been long-time FAA goals that were presented and tracked in annual FAA plans, but others are more detailed examinations of aviation activity and system performance.

Much of the impetus for creating a more responsive FAA began with pressure from the Congress, the DOT, the airlines and the media to find a solution to the dramatic increase in flight delays, which peaked during the summer of 2000. Two important FAA initiatives in response to this concern were the development of the Aviation System Performance Metrics (ASPM) system, which is discussed later in this chapter, and the Airport Capacity Benchmark Report, which was featured in last year's ACE Plan. The FAA is continuing to develop the ASPM system and is updating the Benchmark Report.

#### 2.1.1 Performance Goals

The FAA's final FY 2002 and preliminary FY 2003 performance goals are divided into three categories:

- > GPRA Goals: outcome-oriented goals that define success at the FAA corporate level and are reported in the DOT Performance Plan and Report;
- > Supplemental Goals: high visibility output-oriented goals that help accomplish GPRA goals; and,
- > Organizational Excellence Goals: internal corporate goals focused on meeting customer, employee, and financial expectations

The primary GPRA goal related to this plan is the FAA's performance goal for aviation delay, which is to add aviation system capacity at a rate that matches demand, so that on-time arrival performance improves by one percentage point per year. The airlines, the FAA and DOT's Bureau of Transportation Statistics have all agreed to use the percentage of flights arriving on time (within 15 minutes of scheduled arrival time) as a common measure of aviation delay. A target for 2001 was not established; however, the actual percentage of on-time flights improved from 74.9 percent in 2000 to 76.2 percent in 2001.

The FAA supplementary performance measures that are related to the performance goal for aviation delay are: aviation delays per 100,000 activities; the cumulative increase

in throughput during peak periods at certain major airports; the cumulative increase in direct routings for the en route phase of flight; the percentage of runways in good or fair condition; and, the number of runways accessible in low visibility.

#### 2.1.2 Performance Metrics for the Large-Hub Airports

The FAA is also developing a set of performance indicators that will be used to assess the performance of the large-hub airports. Focusing on these airports will improve the efficiency of the entire NAS since so much traffic passes through these airports. The primary service performance indicators for the operations of the NAS include:

- ➤ Percentage of on-time arrivals
- > Average minutes of arrival delay
- ➤ Ground stop minutes of delay
- > Ground delay program minutes of delay
- > Average daily arrival capacity
- > Airport arrival efficiency rate

These performance indicators rely upon a variety of data sources from DOT and FAA, including the Aviation System Performance Metrics System, the Operations Network (OPSNET), the Enhanced Traffic Management System, and the Air Carrier Statistics Monthly. These, and other, performance indicators are still under development and will be reported on in greater detail in next year's ACE Plan.

#### 2.2 Delays in the National Airspace System

Delay is the traditional measure of NAS performance, but it is not a straightforward measure to calculate on either an individual flight, for an airport, or for the entire system. There are many delay parameters that can be tracked.

By any measure, the number of delays decreased significantly in 2001. This was to be expected, given the decline in traffic during much of the year, especially following September 11. This trend was true for the entire system, as well as for individual airports, although the magnitude of the changes varied among them. Generally, the decline in the number of delays was far greater than the decline in the number of operations because both the system and many of the largest airports had been operating at or near their theoretical capacity. In these cases, the decrease in the number of operations had a disproportionate impact on delays. A related response was observed in 1999 and 2000, when a relatively small increase in the number of operations produced a large increase in the number of delays.

#### 2.2.1 Delays Reported by the Operations Network

The FAA reports the delay performance of the NAS every month, using data from OPSNET. These data come from observations by FAA personnel, who record only aircraft that are delayed by 15 minutes or more during any phase of flight. According to OPSNET data 348,103 flights were delayed in CY 2001, a decrease of 102,186 delays or 22.7 percent

from the 450,289 flight delays in CY 2000. Figure 2-1 shows flight delays for the years for which OPSNET data are available.



Figure 2-1 Annual Flight Delays CY 1990-CY 2001

Source: FAA Operations Network

However, the decreases in delays in 2001 over 2000 were largely the result of the decrease in flying after September 11. Delays for the period from January-August 2001 were 287,320, only a marginal decrease from the 299,767 recorded in the same period in 2000 (a decrease of 4.2 percent). In contrast, for the period from September-December 2001, only 60,783 delays were recorded, a huge decrease from the 150,522 recorded in the same period in 2001 (a decrease of 59.6 percent. Figure 2-2 highlights the sharp divergence after September 11.

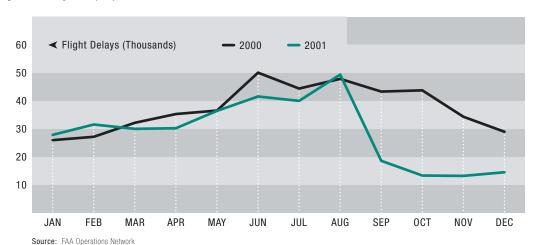


Figure 2-2 Flight Delays by Month, CY 2000 and CY 2001

The total number of aircraft operations during the same period was down by only 3.3 percent. Thus, the rate of delays decreased as well as the absolute number of delays. Figure 2-3 shows the number of delays per 1,000 aircraft operations, by month, for 2000 and 2001. The sharp drop in the rate of delays after September 11 is readily apparent.



Figure 2-3 Flight Delays per 1,000 Operations by Month, CY 2000 and 2001

One of the most valuable aspects of the OPSNET system is that it attributes each delay to one of several causal factors: weather, traffic volume, NAS equipment outages, closed runways, and other causes. The primary causes of delay have varied little year over year, with a large majority of delays attributed to weather (from 65 to 75 percent) and a smaller but significant percentage to traffic volume (12 to 22 percent.) Figure 2-4 shows the distribution of delays by cause for CY 2001.

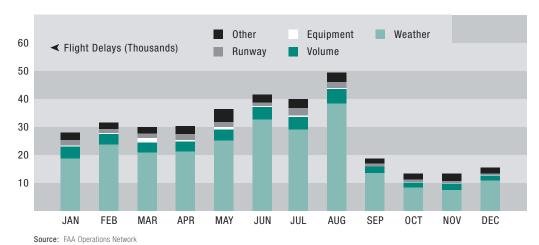


Figure 2-4 Flight Delays by Cause CY 2001

In response to numerous inquiries this year, the FAA began tracking ground delays throughout the NAS. Ground Delay Programs are implemented to control the volume of air traffic to airports where the projected traffic demand is expected to exceed the airport's acceptance rate for a lengthy period of time. The determination that delays are expected to be long lasting rather than temporary is based on the evaluation of weather conditions, forecasts, and projected demand.

The most common reason for the imposition of a Ground Delay Program is the reduction of the airport's acceptance rate, most often because of adverse weather conditions

such as low ceilings and visibility. There were 94,909 ground delays recorded in CY 2001, down sharply from the previous year's 135,752, a decrease of 31.1 percent. As with other measures of activity and delay, much of the decline took place in the last 4 months of the year.

#### 2.2.2 The Aviation System Performance Metrics System

The FAA has developed a new delay measurement system, in cooperation with the Department of Transportation and the airlines, called the Aviation System Performance Metrics (ASPM) system. In November 1999, the FAA, the Air Transport Association and a number of air carriers agreed to share data so that a common set of performance metrics could be computed. The participants agreed that the metrics would be made available without any attempt to assign causality. Currently, 49 airports comprise the ASPM system.

Ten large air carriers have agreed to provide actual flight times directly to the FAA every day through ARINC, a private aviation services company. The times on an individual flight that will be provided are the Out, Off, On and In (OOOI) times. Flight times for four other air carriers are added to the ASPM database once a month, using data that are reported to the Department of Transportation's Bureau of Transportation Statistics. Flight times for all other carriers are estimates. For each individual flight, the OOOI data are merged with data from the FAA's Enhanced Traffic Management System (ETMS) and the Official Airline Guide.

Congress had directed the FAA and the Department of Transportation's Bureau of Transportation Statistics (BTS) to develop a common system for reporting delays. The FAA and BTS have agreed upon a common definition of delay: a flight will be considered delayed if it arrives at the destination gate 15 minutes or more after its scheduled arrival time. ASPM is now being used by the FAA and the DOT Inspector General in tracking delays and other measures of the performance of the NAS. ASPM provides a great deal of descriptive data. A recent DOT report on airline industry metrics cited a number of these, including the following: actual arrivals, arrival delays, the average length of those delays, the percentage of flight departing late, cancellations, the percentage of flights arriving late, gate departure delays, and the length of gate departure delays. Figure 2-5 shows the number of arrival delays for the past 2 calendar years. Arrival delays in CY 2001 decreased to 719,862 from the previous year's 983,565 (a decrease of 26.8 percent).

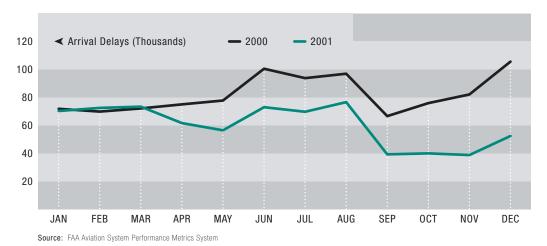


Figure 2-5 Arrival Delays for CY 2000 and CY 2001

The rate of decrease in arrival delays was much greater in the last 4 months of 2001, following the events of September 11, at 48.5 percent, than in the preceding 8 months.

#### 2.3 Performance Data Analysis and Reporting System

The previous sections have discussed performance measures that are released to the public and are used by both government and industry analysts to evaluate the performance of the NAS. The FAA is also developing some measurement tools that are more closely tailored to the daily operation of the air traffic control system. One of these is the Performance Data Analysis and Reporting System (PDARS), a set of tools that assists ATC facility managers in measuring the performance of their facilities. The FAA's Office of System Capacity and NASA's Aviation Safety Program developed it collaboratively.

PDARS extracts radar data from the Host or ARTS computers and processes and distributes these data to FAA facilities via a secure Intranet. These data can be analyzed to uncover the root causes of impediments to NAS operations. PDARS provides the analyst with a set of interactive tools that can access the distributed database of operational data to measure, analyze, and report system performance. PDARS also maintains an archive of historical data, which supports trend analysis and before-after comparisons.

PDARS's operational performance data can be depicted both numerically and graphically. The numerical tools provide the capability to see the large-scale picture of system performance and enable the analyst to identify the causes of performance problems. Reports can be exported to spreadsheet and slide presentation packages. The heart of the graphical depiction system is the Graphical Airspace Design Environment (GRADE), which provides users with a three-dimensional view of airspace and air traffic. GRADE graphics can be exported to slide presentation packages.

PDARS has been deployed at Bay, Northern California, Southern California, Phoenix, Dallas/Ft. Worth, and Houston TRACONs; Oakland, Los Angeles, Albuquerque, Ft. Worth, Houston, and Indianapolis centers, as well as the Air Traffic Control System Command Center. It is scheduled to be deployed at the Jacksonville, Memphis, Atlanta, and Miami centers.



# 3 Airport Capacity Analysis and Enhancements

The analysis of capacity of the nation's airports is a complex process. The primary determinant of an airport's capacity is its physical design: the number, length and location of runways, intersections, taxiways, gates, and the distance between parallel runways. The FAA works with airports and other aviation industry stakeholders to conduct studies to improve the operating efficiency of the infrastructure.

For the past 15 years, the FAA's Office of System Capacity (ASC) has collaborated with airport authorities and air traffic control facilities throughout the U.S. to analyze alternatives for increasing capacity and reducing delays. This chapter summarizes the progress achieved in the number of studies that are underway.

# 3.1 Capacity Benchmark Analysis Continues

In 2001, the FAA issued the Airport Capacity Benchmark Report that analyzed capacity at 31 airports—the 30 busiest U.S. passenger airports and Memphis, a major cargo airport. The objective of the Benchmark Report was to document the number of flights these airports can handle under optimum and reduced weather conditions, and to project future capacity based upon plans for new runways, revised air traffic procedures, and technology improvements. Benchmark rates for each airport were estimated by the air traffic controllers for a particular airport based on their experience in handling flights on a daily basis, and calculated using a computer model of airfield capacity. The facility-provided and calculated estimates were compared to historical arrival and departure data to confirm their validity. In addition, FAA representatives visited several of the airports to validate the methodology.

Once these rates were derived, the benchmarks were then compared to air carrier flight schedules to document how frequently scheduled demand exceeds the benchmarks under optimum and reduced weather conditions. While capacity benchmarks can be exceeded for a short period of time without producing a large number of delays, when the number of scheduled flights exceeds the benchmark for sustained periods of time, delays are inevitable.

In 2002, the FAA began to update the Capacity Benchmark Report and increased the number of benchmarked airports to 35. Cleveland, Ft. Lauderdale, Portland and Midway airports were added due to a combination of factors, such as overall passenger activity and expected major increases in capacity. Figure 3.1 shows the operational volume and delay rates at the 35 benchmarked airports for CY 2001.

Figure 3-1 Capacity Benchmark Airport Delay Rate

Airport (ID)	2000 Operations	2001 Operations	Difference	2000 Delay Rate	2001 Delay Rate	Difference
Hartsfield Atlanta International (ATL)	913,449	887,403	-3%	30.90	24.33	-21%
Boston Logan International (BOS)	508,283	471,989	-7%	47.50	34.45	-27%
Baltimore-Washington International (BWI)	315,348	323,771	3%	6.91	5.10	-26%
Cleveland Hopkins International (CLE)	331,899	291,714	-12%	11.43	6.37	-44%
Charlotte/Douglas International (CLT)	460,370	471,155	2%	5.96	5.20	-13%
Greater Cincinnati International (CVG)	477,844	386,388	-19%	15.40	10.21	-34%
Ronald Reagan National (DCA)	342,790	270,145	-21%	7.90	10.50	33%

Figure 3-1 Continued

Airport (ID)	2000 Operations	2001 Operations	Difference	2000 Delay Rate	2001 Delay Rate	Difference
Denver International (DEN)	528,604	507,826	-4%	2.20	3.60	64%
Dallas-Fort Worth International (DFW)	865,777	802,587	-7%	23.83	21.98	-8%
Detroit Metro Wayne County (DTW)	554,580	523,039	-6%	17.60	15.40	-13%
Newark Liberty International (EWR)	457,182	445,082	-3%	81.20	60.28	-26%
Fort Lauderdale-Hollywood International (FLL)	292,462	290,124	-1%	3.74	5.30	42%
Honolulu International (HNL)	345,496	326,994	-5%	0.02	0.12	500%
Washington Dulles International (IAD)	479,931	424,150	-12%	19.45	8.04	-59%
George Bush International (IAH)	490,568	477,367	-3%	28.10	33.02	18%
New York John F. Kennedy International (JFK)	358,951	317,746	-11%	38.80	24.62	-37%
Las Vegas McCarran International (LAS)	521,300	498,970	-4%	8.01	5.36	-33%
Los Angeles International (LAX)	783,684	738,679	-6%	21.87	22.60	3%
New York LaGuardia (LGA)	392,047	376,919	-4%	155.90	76.98	-51%
Orlando International (MCO)	366,278	326,456	-11%	6.27	3.97	-37%
Chicago Midway (MDW)	298,437	276,520	-7%	11.90	8.05	-32%
Memphis International (MEM)	386,335	393,925	2%	0.37	0.88	138%
Miami International (MIA)	516,545	469,871	-9%	11.32	11.28	0%
Minneapolis-St. Paul International (MSP)	522,253	501,252	-4%	12.74	14.46	14%
Chicago O'Hare International (ORD)	908,977	911,861	0%	63.30	59.49	-6%
Portland International (PDX)	317,477	293,902	-7%	0.51	0.30	-41%
Philadelphia International (PHL)	483,567	467,183	-3%	44.50	40.45	-9%
Phoenix Sky Harbor International (PHX)	638,757	606,666	-5%	21.95	15.31	-30%
Greater Pittsburgh International (PIT)	448,181	451,180	1%	3.78	2.69	-29%
San Diego International Lindbergh Field (SAN)	207,916	206,848	-1%	2.50	4.88	95%
Seattle-Tacoma International (SEA)	445,677	400,670	-10%	10.44	20.76	99%
San Francisco International (SFO)	430,554	387,599	-10%	56.90	38.31	-33%
Salt Lake City International (SLC)	366,933	370,282	1%	1.96	2.27	16%
Lambert St. Louis International (STL)	484,224	478,947	-1%	18.24	18.10	-1%
Tampa International (TPA)	278,632	260,859	-6%	1.56	2.76	77%

ASC has conducted capacity enhancement studies at 25 of the 35 benchmarked airports and continues with its plans to improve the operational efficiencies through a combination of airfield construction, enhanced technology, and improved procedures. Following is an update of the studies that have recently been completed or that are underway.

#### 3.2 Airport Capacity Design Team Studies

Design teams are composed of FAA representatives from the Office of System Capacity, Air Traffic, the Technical Center and the regional Airports office, along with representatives from the airport, airlines, and other parties with aviation interests. When the study is completed, the Airport Capacity Design Team issues a Capacity Enhancement Plan (CEP) that presents a list of recommended actions and estimates the impact of each alternative on delays at the airport.

#### 3.2.1 Chicago O'Hare Task Force Study

The Chicago O'Hare Task Force, co-sponsored by the City of Chicago and the FAA, was created in June 2001 to identify options that could be used to reduce flight delays at O'Hare and to examine the merits of each option. The Task Force released its report in June 2002. The alternatives focused on airspace/technology, air traffic control procedures, and collaborative decision-making. The task force examined 82 alternatives, and 47 were identified as alternatives that would improve the operating efficiency of O'Hare and reduce delays. The Task Force findings identified potential benefits ranging from \$300,000 up to \$38.1 million annually at the 2,772 daily operations level. At the 3,400 daily operations activity level, potential savings range from \$3.4 million to \$99.5 million annually.

#### 3.2.2 Baltimore-Washington International Airport

The Baltimore/Washington International Airport Capacity Task Force is conducting a study to determine when a new runway will be needed at BWI airport and to determine which of the alternatives should proceed for further capacity, cost, and environmental study. The team is now in phase three of the project. In 2001, the FAA released an evaluation of each proposed capacity improvement and simulations were conducted to further evaluate impacts associated with capacity solutions. In 2003, the team will update the forecasts, conduct further capacity analysis, develop cost estimates and conduct environmental studies.

# 3.2.3 Washington Dulles International Airport

Operations at Washington Dulles Airport decreased by 6.6 percent, from 430,082 in FY 2001 to 401,750 operations in FY 2002. Like many U.S. international gateways, traffic recovery at Dulles has been slow. The construction of additional runways will be phased in as demand develops. No new runways have been added at Dulles since it opened in 1962.

Washington Dulles International Airport completed its capacity review and alternatives analysis for the spacing and implementation of a fourth and fifth runways late last year. In addition to the fourth and fifth runways, an extension of the existing crosswind runway to 13,000 feet is being considered. Currently, the longest runway at Dulles is 11,500 feet. The final study includes a recommended airfield layout and a cost estimate.

#### 3.2.4 Airport Air Traffic Ground Control Simulations

ASC is participating in air traffic control ground simulations at Phoenix Sky Harbor International Airport, utilizing the FAA Technical Center's Airfield Delay Simulation Model (ADSIM) and the Airspace Delay Simulation Model (SIMMOD). In 2003, Runway 7L/25R will be closed for 60 days due to construction, and the simulations will assist air traffic controllers in developing the most efficient scenarios for operating aircraft, to determine the best ground route alternatives for arrival and departures.

#### 3.2.5 Portland International Airport

Portland International Airport is ranked 44th in aircraft operations, and is forecast to experience a 26.6 percent increase in operations by 2010, according to 2001 Terminal Area Forecast baseline data. The Port recently decided to adopt low growth forecast figures for decisions regarding the timing of future facility enhancements. Using the Port's local

forecast, the Portland International Airport Capacity Design Team updated its 1996 Capacity Enhancement Plan. The first phase of this multi-phase effort had two goals: one was to evaluate the capacity and delay reduction benefits of the proposed third parallel runway, North/South taxiway, and new technology. The second goal was to determine the delay costs of existing departure noise restrictions. The study was published October 2001, and is available on the ASC web site. The second phase of the study was initiated Fall 2002 and will further analyze the capacity and delay reduction benefits of the proposed third parallel runway by comparing the centralized and decentralized terminal options along with the reconfiguration of associated taxiways. This study is expected to be completed at the end of 2003 with findings included in the following year's ACE Plan.

# 3.2.6 Santiago, Chile Capacity Enhancement Project

Because the FAA's recognized expertise in evaluating capacity enhancements, foreign operators often ask for assistance. A team comprised of the FAA and the Dirección General Aeronáutica Civil (DGAC) of Chile conducted an evaluation of a proposed DGAC project to increase the capacity of the Arturo Merino Benitez International Airport that was released in January 2002. The FAA conducted an assessment of airport capacity and evaluated the impact of a proposed closing of an existing runway for refurbishments. Additionally, the FAA proposed use of radar procedures and implementation of more extensive use of visual separation standards, to enhance airport capacity models. The team determined that the best option is construction of a new, converging diagonal runway, which will provide coverage for the temporary closing of the main runway closing, as well as provide a long-term benefit to future operations.

# 3.3 Demand Management Solutions

Demand management involves taking specific actions to reduce, redistribute, or increase aircraft operations to address a particular problem. Conditions that might suggest such a solution include excess demand that results in consistently high levels of flight delay, particularly at an airport with limited expansion possibilities that is significant to the operation of the NAS. Several U.S. airports are "slot-controlled," meaning that the number of flights per day is capped. Conversely, communities that are undeserved by airlines may require special measures to ensure that rural communities have access to air service.

# 3.3.1 Demand Management at LaGuardia

LaGuardia is a slot-controlled airport, which means that the number of take-offs and landings are limited. In 2000, LaGuardia accounted for 25 percent of flight delays nationwide. In 2001, there was a sharp increase in the number of new entrant carriers, and consequently delays, when new legislation increased the number of available slots and increased access to small carriers. To help remedy this situation, a moratorium on new flights was imposed and there was a scale back of the recently added flights. Subsequently, a temporary lottery was instituted. The lottery system gives priority to operators using larger aircraft, and variations of the current slot allocation system would set aside certain slots for service to small communities and possibly new entrants. The FAA has extended the current slot lottery system through October 2004. So far, this solution,

which includes trading and leasing slots, has provided a more efficient allocation system and delays have been sharply reduced.

This lottery extension provides the FAA with more time to establish a long-term demand management system. In 2002, the Port Authority of New York and New Jersey conducted delay reduction studies for LaGuardia and Kennedy airports in cooperation with Capacity Enhancement Task Force made up of representatives from the FAA, airlines, other users, and the Port Authority.





# 4 Airport Development

An airport is divided into airfield and landside sections. The airfield is composed of runways, taxiways, apron areas, aircraft parking positions, air traffic control facilities, and navigational aids. The landside consists of the terminal building and the associated access roads. The ACE Plan primarily addresses airfield capacity. Although landside capacity remains an important aspect of the air transportation system, particularly given the heightened security initiatives underway, airport terminals are managed by the airport operators, and with the exception of its role in administering grants and other financing options, the FAA is not actively involved in landside capacity enhancement. The summary of airport construction contained in this chapter and Appendix D applies to the airfield.

The general principles that were established over half a century ago that guide the Federal Government's involvement and subsequent policies regarding airports remains relevant, in the context of the cyclical nature of the traffic and new economic challenges facing the infrastructure. Therefore, it is appropriate to review these principles, relative to the airport development activities described in Chapter 4.

# 4.1 The Guiding Principles:5

- > Airports should be safe and efficient; located at optimum sites; and developed and maintained to appropriate standards.
- > Airports should be affordable to both users and the Government, relying primarily on user fees and placing minimal burden on the general revenues of local, state, and Federal Government.
- > Airports should be flexible and expandable, able to meet increased demand and to accommodate new aircraft types.
- > Airports should be permanent, with assurances that they will remain open for aeronautical use over the long term.
- > Airports should be compatible with surrounding communities, maintaining a balance between the needs of aviation and the requirements of residents in neighboring areas.
- > The airport system should support national objectives for defense, emergency readiness, and postal delivery.
- ➤ The airport system should be extensive, providing as many people as possible with convenient access to air transportation, typically not more than 20 miles travel to the nearest National Plan of Integrated Airport Systems (NPIAS) airport.
- > The airport system should help air transportation contribute to a productive national economy and international competitiveness.

<sup>5</sup> National Plan of Integrated Airport Systems (NPIAS) 2001-2005.

#### 4.2 Construction of New Runways, Extensions, and Taxiways

New runway construction remains the most effective capacity enhancement solution. However, often the most congested airports often do not have land that is easily accessible for the addition of runways, taxiways and landing aids. Changing departure and approach patterns frequently cause noise impacts that adversely affect noise-sensitive areas such as homes, hospitals, churches and schools. The FAA works closely with states, airlines, airports and neighboring communities to help craft alternatives that increase capacity while minimizing the number of people exposed to increased noise. The FAA has been working to streamline the process of assessing environmental impacts of proposed projects to help reduce the amount of time from the conception to construction of airport enhancements, without compromising the quality of the environmental review process.

# 4.3 Improvements in the Environmental Impact Statement (EIS) Program Continue

In 2002 the FAA continued its efforts to streamline the EIS preparation for projects that normally require extensive documentation (i.e., new airports, new runways, and major extensions). Figure 4.1 highlights the FAA's proposed initiatives for streamlining the EIS process for projects at the 31 Large, Hub, Primary Airports.

Figure 4-1 Proposed EIS Streamlining Initiatives <sup>6</sup>

Streamlining Initiative	Benefit
For major runway projects at large, hub, primary airports, establish EIS Teams comprised of FAA, airport, and legal personnel experienced in EIS preparation.	The Office of Airports (ARP) has established EIS Teams for proposed projects at: San Francisco Int'l.; Washington-Dulles Int'l.; Philadelphia Int'l.; O'Hare Int'l a proposed airport at Peotone, IL; New Orleans Int'l.; and Fort Lauderdale-Hollywood Int'l. The Teams are intended to reduce time consuming, major revisions to draft EISs by ensuring draft EISs adequately address an array of technical and legal issues. This accelerates FAA's preparation of the final EIS, thereby allowing ARP to more quickly decide the fate of capacity enhancing projects at these dominant airports.
Reallocate FAA staff to support environmental work.	ARP has converted 5 existing vacancies to environmental specialist positions.  This has increased the number of people managing and preparing EISs.
Maximize consultant resources to assist FAA with routine tasks (e.g., initial administrative record assembly, writing draft letters, memos, or similar correspondence, researching issues).	Using consultants to complete specific administrative duties allows ARP environmental specialists to concentrate on preparing and managing EISs, instead of writing preliminary versions of various administrative memos and letters.
Streamline process and use more categorical exclusions.	FAA is expanding its categorical exclusion list. This will reduce the number of environmental documents ARP environmentalists must prepare. It will allow them to focus on EISs necessary for projects occurring at major hub airports typically having significant environmental impacts.
Write and issue Best Practices Information (BPI) on preparing and managing EIS.	The BPI discusses proven methods to facilitate EIS preparation and management and to meet project schedules.

Large, hub, primary airports are defined as those airports that enplane more than 1 percent of the total enplanements. Together, these airports enplane more than 70 percent of U.S. air passengers. The 31 Large Hub Primary Airports listed in Figure 4.2 are based upon the CY 2001 airport ranking by enplanements.

<sup>6</sup> Report to Congress on Environmental Review of Airport Improvement Projects, U.S. DOT, May 2001.

Figure 4-2 The 31 Large, Hub, Primary Airports

1	Hartsfield Atlanta International (ATL)	17	Seattle-Tacoma International (SEA)
2	Chicago O'Hare International (ORD)	18	Boston Logan International (BOS)
3	Los Angeles International (LAX)	19	Philadelphia International (PHL)
4	Dallas-Fort Worth International (DFW)	20	Charlotte-Douglas International (CLT)
5	Phoenix Sky Harbor International (PHX)	21	New York La Guardia (LGA)
6	Denver International (DEN)	22	Baltimore-Washington International (BWI)
7	Las Vegas McCarran International (LAS)	23	Pittsburgh International (PIT)
8	San Francisco International (SFO)	24	Honolulu International (HNL)
9	George Bush International (IAH)	25	Salt Lake City International (SLC)
10	Minneapolis-St. Paul International (MSP)	26	Greater Cincinnati International (CVG)
11	Detroit Metropolitan Wayne County (DTW)	27	Washington Dulles International (IAD)
12	Newark Liberty International (EWR)	28	Fort Lauderdale-Hollywood International (FLL)
13	Miami International (MIA)	29	Tampa International (TPA)
14	New York John F. Kennedy International (JFK)	30	San Diego International Lindbergh Field (SAN)
15	Orlando International (MCO)	31	Chicago Midway (MDW)
16	Lambert St. Louis International (STL)		

A number of the busiest airports have completed new runways or other runway construction projects over the past 5 years. Figure 4-3 shows that 7 new runways were opened from January 1997 to October of 2002. Another 19 construction projects were completed for the same period, including 15 runway extensions, 1 renovation, 2 reconstructions and 1 realignment. There are 39 construction projects planned between November 2002 and 2007 shown in Figure 4-4, including the building of 13 new runways.

Figure 4-3 Completed Runway Construction Projects January 1997 to October 2002

Airport (ID)	New	Extension	Renovation	Reconstruction	Realignment	Year	Runway
Austin-Bergstrom International (AUS)			•			1997	17R/35L
Boise Air Terminal (BOI)		•				1997	10L/28R
Port Columbus International (CMH)		•				1997	10L
Grand Rapids Kent County International (GRR)		•				1997	18/36
Las Vegas McCarran International (LAS)				•		1997	1L/19R
Chicago Midway (MDW)				•		1997	4R/22L
Louisville International (SDF)	•					1997	17R/35R
Memphis International (MEM)	•					1997	18L/36R
Grand Rapids Kent County International (GRR)					•	1998	17/35
Little Rock Adams Field (LIT)		•				1998	4L/22R
Milwaukee General Mitchell International (MKE)		•				1998	7L/25R
Madison/Dane County Regional (MSN)	•					1998	3/21
Palm Springs Regional (PSP)		•				1998	31L/13R
Albuquerque International (ABQ)		•				1999	12/30

Figure 4-3 Continued

Airport (ID)	New	Extension	Renovation	Reconstruction	Realignment	Year	Runway
Austin-Bergstrom International (AUS)	•					1999	17L/35R
Greenville-Spartanburg (GSP)		•				1999	3L/21R
Philadelphia International (PHL)	•					1999	8/26
Memphis International (MEM)		•				2000	18C/36C
Phoenix Sky Harbor International (PHX)	•					2000	7/25
Palm Beach International (PBI)		•				2000	9L/27R
San Jose International (SJC)		•				2000	12L/30R
Des Moines International (DSM)		•				2001	5/23
Detroit Metropolitan Wayne County (DTW)	•					2001	4L/22R
El Paso International (ELP)		•				2001	4/22
Kahului (OGG)		•				2001	2/20
Phoenix Sky Harbor International (PHX)		•				2001	8L/26R

Figure 4-4 Runway Construction Projects November 2002 to December 2007

D – Deferred  Airport (ID)	New	Extension	Reconstruction	Runway Identifier	Estimated Cost (\$M)	Planned Operational Year	In Progress
Albany County (ALB)		•		10/28	TBD	2002	•
Birmingham (BHM)		•		5/23	TBD	2002	•
Dallas-Fort Worth International (DFW)		•		18L/36R	\$32.2	2002	•
George Bush Intercontinental (IAH)		•		15R/33L	TBD	2002	•
Dayton International (DAY)		•		6R/24L	TBD	2002	•
Pensacola Regional (PNS)		•		8/26	TBD	2002	•
Sarasota Bradenton (SRQ)		•		14/32	TBD	2002	•
Manchester (MHT)		•		6/24	TBD	TBD	
Cleveland Hopkins International (CLE)		•		6L/24R	\$458.0	2004	
Denver International (DEN)	•			16R/34L	\$167.0	2003	•
Dallas-Fort Worth International (DFW)		•		18R/36L	\$400.0	TBD	D
George Bush International (IAH)	•			8L/26R	\$260.0	2003	•
Orlando International (MCO)	•			17L/35R	\$203.0	2003	•
Miami International (MIA)	•			8/26	\$215.0	2003	•
San Jose International (SJC)		•	•	12R/30L	\$61.4	2003	
Hartsfield Atlanta International (ATL)	•			10/28	\$133.0	2006	
Charlotte-Douglas International (CLT)	•			18W/36W	\$187.0	TBD	D
Greensboro Piedmont Triad International (GSO)	•			5L/23R	\$96.0	2004	
Minneapolis-St. Paul International (MSP)		•		4/22	\$11.4	2004	
Minneapolis-St. Paul International (MSP)	•			17/35	\$563.0	2004	•

Figure 4-4 Continued

D – Deferred  Airport (ID)	New	Extension	Reconstruction	Runway Identifier	Estimated Cost (\$M)	Planned Operational Year	In Progress
Norfolk International (ORF)	•			5R/23L	\$100.0	2004	
Knoxville McGhee-Tyson (TYS)		•		5L/23R	\$7.0	2004	
Albany County (ALB)		•		1/19	\$7.5	2005	
Boston Logan International (BOS)	•			14/32	\$100.0	2006	
Greater Buffalo International (BUF)		•		14/32	\$4.9	2005	
Greater Cincinnati International (CVG)	•			17/35	\$233.0	2005	•
Greater Cincinnati International (CVG)		•		9/27	\$18.2	2005	
Dallas-Fort Worth International (DFW)		•		17C/35C	\$25.0	2005	
Fort Lauderdale-Hollywood International (FLL)		•		9R/27L	\$898.0	2005	
Lubbock International (LBB)		•		8/26	\$15.0	2005	
Manchester (MHT)		•	•	17/35	\$65.0	2005	
Cleveland Hopkins International (CLE)		•		5R/23L	\$40.0	2006	
San Antonio International (SAT)		•		3/21	\$20.0	2006	
San Antonio International (SAT)		•	•	12L/30R	\$11.0	2006	
Lambert St. Louis International (STL)	•			12R/30L	\$1,100.0	2006	
Washington Dulles International (IAD)	•			1W/19W	\$200.0	2007	

# 4.4 Resources Supporting Airport Development

Federal interest in the capital investment for airports is guided by the government's commitment to ensure safety and security, preserve and enhance system capacity, assist small commercial and general aviation airports, fund noise mitigation, and protect the environment.

Airport revenue comes from numerous sources—either directly or indirectly from revenue generated by the airlines, their passengers, and airport vendors, or through the taxes collected from aviation system users. Capital development funds are provided by the public and private sectors, including airport bonds, federal and state grants, passenger facility charges (PFCs), and airport-generated income.

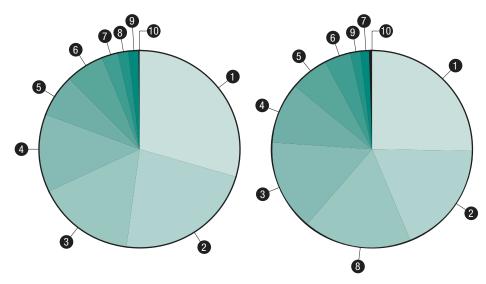
#### 4.4.1 Airport Improvement Program

The FAA administers the Airport Improvement Program (AIP) and it remains a critical source of support for the nation's civilian air transportation infrastructure. The AIP federal grants are financed from taxes and fees collected from and dispensed to civilian airports from the Airport and Airway Trust Fund.

The fund was created by Congress more than 30 years ago to fund improvements to airports and to the air traffic control system. It also provides funding for FAA operating expense. Revenues in the trust fund come primarily from airline user fees and/or fuel taxes. The Airport and Airway Trust Fund finances the Airport Improvement Program (100% trust fund), the Facilities and Equipment Program (100% trust fund), the Research, Engineering and Development Program (100% trust fund), and the FAA Operations and Maintenance Programs (allocations vary, usually at 50% trust fund and the remainder from general funds).

The AIP program provides federal grants for the planning and development of eligible capital projects that support airport operations, including runways, taxiways, aprons, and noise abatement. Airport sponsors and non-federal contributors must provide the portion of the total project cost that is not funded with by AIP grants. In FY 2002, the FAA awarded \$3.3 billion in AIP grants, which included an allocation of \$561 million for security projects. This unprecedented increase in AIP grant funds awarded to airports for security projects in FY 2002 has affected the amount of funding available for some airport development projects, in comparison to FY 2001. In FY 2002, \$477 million was awarded to capacity projects, representing a decline of 40.3 percent from FY 2001. Figure 4.5 shows the distribution of AIP Grants (in millions) by Development Category, FY 2001 and 2002.

Figure 4-5 Distribution of AIP Grants by Development



Development Category	2001 Grant	% of 2001 Budget	2002 Grant	% of 2002 Budget
1. Standards	\$953.7	29.4%	\$812.4	25.2%
2. Reconstruction	\$729.7	22.5%	\$592.7	18.4%
3. Capacity	\$510.2	15.8%	\$477.6	14.83%
4. Environment	\$410.8	12.7%	\$319.8	9.93%
5. State Block Grant	\$223.2	6.9%	\$202.7	6.2%
6. Safety	\$200.6	6.2%	\$137.5	4.2%
7. Other	\$86.2	2.6%	\$45.6	1.4%
8. Security	\$55.7	1.7%	\$561.0	17.4%
9. Planning	\$54.6	1.6%	\$53.5	1.6%
10. Statutory Emphasis	\$9.4	0.2%	\$18.4	0.5%
Totals	\$3,234.0	100.0%	\$3,221.0	100.0%

<sup>7</sup> Federal Aviation Administration, Office of Airport Planning and Programming, APP-500.

Airports that qualify for AIP funding must fit one of the following categories:

- > Publicly owned commercial service airports that enplane 2,500 or more passengers annually and have scheduled service
- ➤ Primary airports
- > Cargo service airports, served by aircraft that only provide air transportation of property with an aggregate annual landing weight of more than 100 million pounds
- > Relievers
- > Remaining airports not specifically defined in the act, referred to as GA airports.

#### 4.4.2 Passenger Facility Charges

Passenger Facility Charges (PFCs) are fees paid by the enplaning passengers, using airports that the FAA has authorized to collect these charges. The airlines collect PFCs as an add-on to airfare. The maximum PFC rate now is \$4.50 per trip segment, with a cap of \$18 for a roundtrip ticket. Since 1992, the FAA has approved over 300 airports to impose this fee, representing eventual collections of more than \$32.8 billion. PFCs are used to finance capital improvements to address safety, capacity, airport access, and security needs, as well as noise reduction projects. PFCs can also be used for the enhancement of competition between or among carriers, or the payment of interest on airport revenue bonds.

Every PFC is tied to a particular capital improvement project that has been approved by the FAA. Only 16 percent of this amount approved for collection is currently targeted for airside improvements. The majority of funds are earmarked for landside improvements—such as security and terminal projects; noise abatement—that involve land acquisition, soundproofing, monitoring and airport planning, and access improvements, such as roadways, rail, land and planning. As a result of the decline in air traffic in 2001, which is not expected to recover to pre-September 11 levels for at least another 2 years, this revenue source has been significantly reduced.

#### 4.4.3 User Charges

Airport user charges include aircraft landing fees; apron, gate-use, or parking fees; fuel flowage fees; and terminal charges for rent or use of passenger hold rooms, ticket counters, baggage claim areas, administrative support, hangar space, and cargo buildings. Non-airport user charges include revenue from sources such as terminal concession rentals and fees, automobile parking, car rentals and interest income.

#### 4.4.4 Bonds: Revenue and General Obligation

The issuance of bonds has been the primary means of financing airport development projects at commercial service airports. Most airport debt financing has used tax-exempt general airport revenue bonds (GARBS), which are secured by an airport's future revenue. Over the years, the use of general obligation bonds, which have a stronger credit standing because they are backed by government taxation power, has declined. This trend is attributed to the improved acceptance of GARBS.

Bond debt service is typically financed through airport user charges and PFCs. Historically, airport revenue has kept pace with increased debt-service costs, and so the ability to issue new debt has not been harmed. However, the decline in air traffic following September 11 has negatively impacted airport finances.

# 4.4.5 Other Sources of Funding

While most U.S. airports are self-sustaining, state and local governments contribute to the development of community airports, offering matching grants to secure federal support, providing direct grants to fund airport maintenance projects, and financing the installation of navigation aids. To expand air service and encourage competition, local and state municipalities, and the Federal Government have also supported airport and air service development marketing initiatives. Private sources of funding may also be available through airport tenants, third-party developers and private entities.

# 4.5 Other Airport Development Activities

There are other types of programs that currently enhance or have the potential to improve system capacity in the future. These programs provide facility and air service options that are consistent with Guiding Principles in the beginning of Chapter 4.

# 4.5.1 The Military Airport Program

The FAA chooses sites for this program, which is an AIP set-aside that provides a fixed percentage of the discretionary monies to fund the conversion of facilities that have converted or plan to convert from military to civilian or joint use. Another program benefit is the ability to use funds for projects not normally funded by AIP. Last year's AIR-21 law increased the total number of airports participating in MAP from 12 to 15. In July, the FAA selected five new sites including Guam International, in Agana, Guam, San Bernardino International, San Bernardino, California, Sawyer Airport, in Marquette Michigan, MidAmerica Airport, Belleville, Illinois, and Plattsburgh International in Plattsburgh, New York.

In addition to the five airports recently added to the program, other participating airports are: Pease International Tradeport, Portsmouth, New Hampshire; Cecil Field, Jacksonville, Florida; Okaloosa Regional Airport, Valparaiso, Florida; Tipton Airport, Odenton, Maryland; Southern California Logistics Airport, Victorville, California; Sacramento Mather Airport, Sacramento, California; March Inland Port, Riverside, California; Oscoda-Wurtsmith Airport, Oscoda, Michigan; Gray Army Airfield, Killeen, Texas; and Chippewa County International Airport, Kincheloe, Michigan.

#### 4.5.2 Reliever Airports

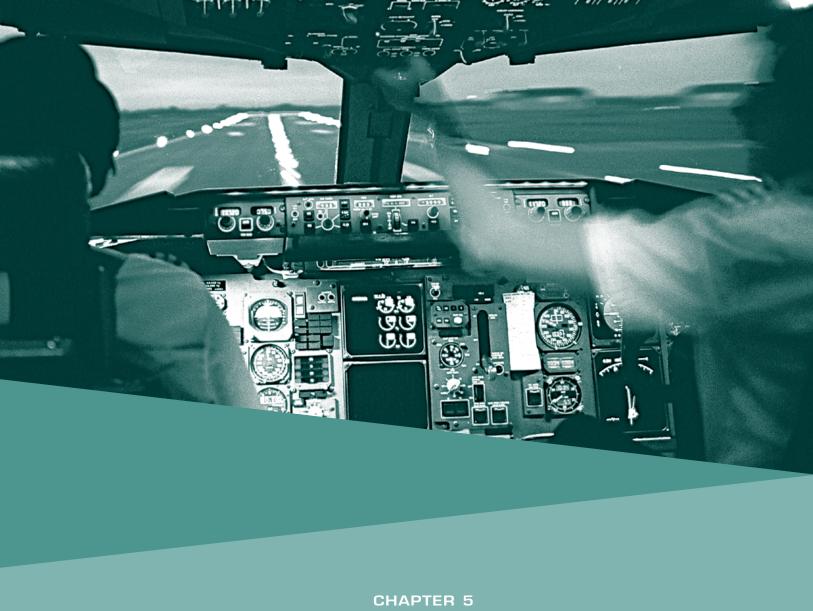
The FAA has encouraged the development of high capacity general aviation airports in major metropolitan areas to provide general aviation with attractive alternatives to using congested airports. There are 334 of these specialized airports, called "reliever airports." In some cases, reliever airports have proven to be an effective element in a region's air transportation system.

This year, there have been very few developments at reliever airports, as major carriers significantly reduced capacity, and major airport congestion forcing alternative route solutions was not a prevailing problem. MidAmerica Airport, located in Mascoutah

Illinois, which is 24 miles east of St. Louis Lambert International, serves primarily as a reliever for Lambert's cargo traffic. MidAmerica, which is a joint-use facility with Scott Air Force Base, will use its MAP funds to build a cargo facility. With waning passenger loads, MidAmerica has not yet been able to generate its own passenger traffic. The reliever airport lost its sole commercial passenger carrier, Pan American Airlines in January 2002.

#### 4.5.3 Essential Air Service to Small Communities Continues

This program was established when the Airline Deregulation Act (ADA) went into effect in 1978. Congress added a new section to the Federal Aviation Act to ensure that smaller communities would retain a link to the national air transportation system, with Federal subsidy where necessary. The Essential Air Service (EAS) Program subsidizes air travel to approximately 100 rural communities. In 2001, there was a decline of 19 percent in air service to smaller communities, with the majority of the decline coming from markets served by turboprops. This significant decline can primarily be attributed to a combination of the weakening economy and the events of September 11. In July of CY 2002, under provisions of AIR-21, the U.S. Department of Transportation (DOT) granted 40 small communities \$20 million under a pilot program to address local air service problems. These funds will help resolve issues such as high fares and insufficient levels of service. Under this program, the communities will match awards by nearly 75 percent.



# 5 Operational Procedures

The FAA continually enhances the procedures governing the operation of aircraft in the NAS. Procedural changes are implemented to increase airspace capacity, take advantage of improved aircraft and avionics performance, maximize the use of a new runway, or simply to make the existing air traffic management system work more efficiently.

Although less expensive and time-consuming than other capacity-enhancing solutions, such as building new runways, the development and implementation of new procedures is a complex process. The collaboration of the air traffic controllers and pilots who will be using the procedures is essential. In addition, both controllers and pilots must receive appropriate training before new procedures can be implemented.

Recent FAA actions to develop new operational procedures are discussed in this chapter. These procedures result in more efficient operations in the en route, arrival and departure, and approach phases of flight (Figure 5-1), and ultimately give pilots more flexibility in determining their route, altitude, speed, departure and landing times.

Figure 5-1 Operating Environments Benefited by Procedural Enhancements

		Operating Environment	
Procedural Enhancements	En Route	Arrival and Departure	Approach
Spring/Summer 2002	•	•	
RNAV Procedures	•	•	•
Reduced Separation Minima	•		
Civilian Access to SUA	•	•	
Approaches to Closely Spaced Parallel Runways			•

# 5.1 Spring/Summer 2002

Because intersecting airways interconnect the NAS, a weather delay in one part of the nation's airspace can have a ripple effect, spreading delays across the country. For the past three years, the FAA and the airlines have collaborated in developing new operational procedures, aided by information technology, to improve traffic flow during the severe weather events that are typical in the spring and summer. The collaborative effort, referred to as the Spring/Summer plan, began in 2000, and the approaches to maintaining smooth operations during severe weather have been gradually improved over the years. Key elements of the Spring/Summer 2002 plan are described in the section below.

#### 5.1.1 Strategic Planning

The strategic planning team at the Command Center conducts conference calls with major air traffic facilities and representatives from the user community, every 2 hours, 24 hours a day, 7 days a week to discuss the status of the system and constraint projections, and to develop the strategic plan of operations. The strategic plan of operations is a collaborative agreement on how to deal with severe weather and other system constraints, and ensure a degree of predictability for all stakeholders by looking ahead 2 to 6 hours and providing a common view of system issues. The resulting strategic plan is posted on the Command Center web site and sent via advisory to air traffic facilities and the user community.

Since its inception, the number of conference calls has increased to cover a larger portion of the day (originally 7 am to 9 pm EST). The improved use of weather information,

route coordination, and collaborative decision-making, described below, all contribute to more effective strategic planning and efficient traffic flow.

# 5.1.2 Improved Use of Weather Information

The Collaborative Convective Forecast Product (CCFP) facilitates strategic traffic flow planning by forecasting thunderstorm activity that may impact the NAS. It consists of 2, 4, and 6-hour forecasts of convection that will cover at least 25 percent of the area identified. Forecasts are prepared by the National Weather Service's Aviation Weather Center in collaboration with meteorologists from the airlines, the FAA's Center Weather Service Units, and National Business Aviation Association members. The area of coverage is the continental United States and coastal waters. In 2003, the coverage will be expanded to include portions of Ontario and Quebec, Canada. CCFP forecasts are available on several websites.

To facilitate route selection through weather-affected airspace, the FAA is exploring use of the prototype Corridor Integrated Weather System (CIWS) for near-term forecasts. The CIWS combines data from a number of radars to provide 0-to-2 hour forecasts on localized weather systems. This information will help the FAA to move airplanes through or around weather systems and quickly recapture airspace lost during thunderstorms.



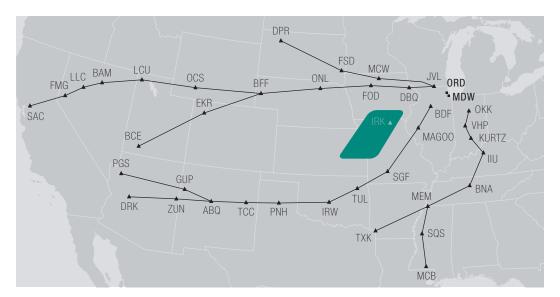
Figure 5-2 CCFP Forecast Examples from the Aviation Weather Center Website

#### 5.1.3 Route Coordination

The FAA and the airlines work together to develop alternatives to facilitate the efficient re-routing of traffic during severe weather and periods of congestion. The availability of pre-determined alternate routes provides flexibility in dealing with most severe weather events and expedites the route coordination process. It also allows airlines to plan ahead for possible route changes when severe weather is forecast. The Playbook contains textual and graphical displays of specific route alternatives for the most common scenarios that occur during severe weather seasons. The number of alternative routings available in

the national Playbook has increased since the Spring/Summer initiative began, from 20 plays in 2000 to 114 plays in 2002. Airlines and controllers can use the Playbook to evaluate alternatives if a CCFP forecast indicates that a specific airway is likely to be blocked. Figure 5-3 shows a map of playbook routes available for flights into Chicago O'Hare when a weather system blocks one portion of an airway.

Figure 5-3 Examples of Playbook Routes into Chicago



The FAA and airlines can also access a list of alternative routes called coded departure routes (CDRs) by querying a database called the Route Management Tool (RMT). The RMT facilitates information exchange between the FAA en route centers, the Command Center, and the airline user community, which mitigates potential adverse impacts to air traffic during periods of severe weather or congestion. Coded departure routes have eight character identifiers. The first three characters identify the departure airport, the second three the arrival airport, and the last two are unique route identifiers. For example, the database contains three CDR's for Atlanta to Miami, each corresponding to a different departure fix (Figure 5-4). The FAA plans to incorporate the Playbook routes into the Route Management Tool so that both playbook routes and CDR's can be accessed on one system.

Figure 5-4 Coded Departure Routes for Atlanta to Miami

#	Route Code	Origin	Destination	Departure Fix	Route String	Departure ARTCC	Arrival ARTCC	Traversed ARTCCs
1	ATLMIA9E	KATL	KMIA	EATWO	KATL EATWO IRQ CRG OMN J79 VRB HEATT5 KMIA	ZTL	ZMA	ZJX ZMA ZTL
2	ATLMIA9W	KATL	KMIA	WEONE	KATL WEONE MGM SZW J43 PIE CYY3 KMIA	ZTL	ZMA	ZJX ZMA ZTL
3	ATLMIAPR	KATL	KMIA	SOONE	KATL SOONE J89 J75 RSW CYY3 KMIA	ZTL	ZMA	ZJX ZMA ZTL

#### 5.1.4 New Route Alternatives

In 2002, the FAA expanded the airspace available when standard routes are blocked by weather or congestion by offering six Canadian routes, two of which Canada has agreed to have available at all times. In addition, off the east coast of the U.S., flights now have access to two new off-shore routes through the Virginia Military Capes (VACAPES) airspace (for a total of eight) when it is not in use by the military. Use of the VACAPES requires coordination between the military, air traffic facilities and the Command Center. In 2001, the VACAPES routes were only available about 30 percent of the time. The recent addition of new oceanic radar sectors to the east of the VACAPES airspace provides additional alternative north-south routes. The radar coverage allows aircraft to fly closer to the military airspace due to the reduced separation standards applicable in a radar environment. Aircraft that want to use the new routes must be equipped to fly over the ocean. The offshore routes are longer than the overland routes, but flights save time in severe weather because flights between New York and Florida can be routed to the new sectors to avoid storms that otherwise delay take-off. Figure 5-5 shows a map of the VACAPES and the new offshore radar sectors.

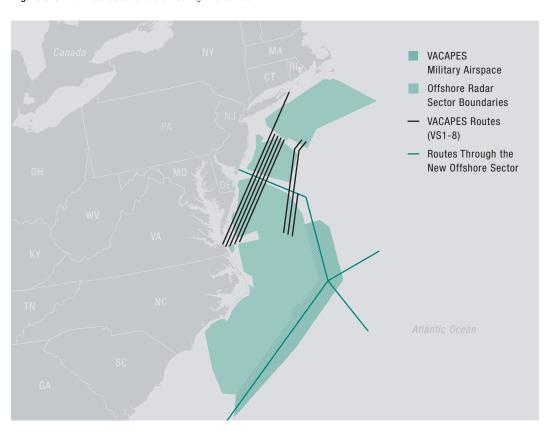


Figure 5-5 New East Coast Offshore Routing Alternatives

# 5.1.5 Collaborative Decision-Making

Collaborative Decision-Making (CDM) is a joint government/industry initiative aimed at improving air traffic management through increased information exchange among the various parties in the aviation community and improved automated decision support tools.

The program is one of five core technologies in the FAA's Free Flight program and includes participants from the FAA, air carrier industry, private industry, and academia. The FAA uses CDM to provide real-time information on weather, delays, cancellations and equipment to more than 30 airlines, business aviation, and major FAA air traffic control facilities.

Recent improvements to the Enhanced Traffic Management System (ETMS), the real-time operations system used by the FAA and airlines to manage traffic through the nation's airspace, have facilitated CDM. For example, ETMS now allows traffic managers to identify Flow Constrained Areas, where constraints such as volume or convective activity may require alternative traffic management initiatives such as re-routes or miles-in-trail restrictions. Early identification of these Flow Constrained Areas will allow traffic specialists to identify and evaluate where multiple flights are attempting to avoid the same storm. Airline dispatchers will use the information to assess which flights will need to be re-routed.

Flights destined for an airport where visibility is low are often held before they leave the ground, in order to avoid circling the airport when they arrive. A new version of ETMS contains information on changing airport weather conditions, known as Runway Visual Range (RVR) data, at 48 high-activity airports. Formerly, visibility data was only available directly from the traffic control tower at each airport. Now that this RVR data is available in real-time nationwide, airlines and the FAA are notified immediately that conditions at the destination airport are improving. The immediate availability of RVR data helps the airlines and FAA to quickly agree on ending ground delay programs and resuming regular service.

The new version of ETMS also includes a Simplified Substitution Process for airlines to request priority handling of certain flights. In earlier versions of ETMS, scheduling determinations were based primarily on the scheduled arrival time of each flight. Now, if a certain flight has many passengers who need to make connections or a crew near the end of its shift, the airline has a much simpler method to easily override the time-of-arrival list and give that flight a higher priority than others operated by the same carrier. This feature has special significance at hub airports, where it will help airlines to reduce the number of missed connections attributable to weather delays.

#### 5.2 Area Navigation Procedures

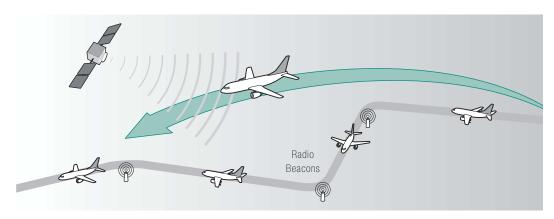
The accuracy of modern aviation navigation systems and user requests for increased operational efficiency in terms of direct routings have resulted in the development of area navigation (RNAV) procedures for the en route, terminal, and approach phases of aircraft operations. RNAV is a method of navigation that permits aircraft operation on any desired flight path, without reference to ground-based navigation aids. Figure 5-6 is a conceptual illustration of the doglegs associated with routes determined by ground-based navigation aids versus a direct RNAV route. Aircraft equipped with a qualified flight management system (FMS), GPS, or DME/DME sensors can safely fly RNAV routes. RNAV operations provide a number of additional advantages over conventional navigation, including:

- > Flexibility in permitting user-preferred routes that take advantage of optimal altitude and wind;
- > Parallel routing to accommodate a greater flow of en route traffic;
- > Establishment of bypass routes around high-density terminal areas and special use airspace;

- ➤ More efficient traffic patterns (i.e., between the en route, arrival, and final approach segments of the flight path);
- > Fewer voice transmissions between the pilot and controller to execute approaches;
- > Smoother and safer descent paths on approach; and,
- > Approaches to more airports in low-visibility conditions.

The concept of Required Navigational Performance (RNP), which defines levels of RNAV accuracy, is explained below, followed by a discussion of the FAA's development of RNAV approach procedures. More information on the implementation of RNAV concepts to enhance airspace capacity en route and in the arrival and departure phases of flight is provided in Chapter 6.

Figure 5-6 Direct RNAV Routes vs. Routes Determined by Ground Based Navigation Aids



#### 5.2.1 Required Navigational Performance

Required navigational performance (RNP) defines RNAV accuracy requirements for a variety of operations. For example, terminal RNP operations are defined as RNP-1 meaning that the aircraft's navigation system must be able to maintain a total error of plus-or-minus one nautical mile 95 percent of the time. RNP specifies the performance requirements for the aircraft, but does not require that an aircraft be equipped with a specific navigation sensor. Figure 5-7 shows examples of RNP-based RNAV operations, and how they may be applied.

Figure 5-7 Examples of RNP Applications

Operation	RNP Type	Example Application
Oceanic/Remote	RNP-10	50 NM Separation
Oceanic/Remote	RNP-4	30/30 NM Separation
En Route Domestic	RNP-2 RNAV	8 NM Route Spacing
Terminal Area	RNP-1 RNAV	4 NM Spacing
Approach	RNP-0.3 RNAV	LNAV (Non-Precision Approach)
Approach	RNP-0.3 RNAV	LNAV/VNAV (Approach Procedure with Vertical Guidance)

Note: These are examples of how RNP may be applied. Other types of operations may also be developed and applied.

Source: FAA Advisory Circular No. 20-RNP

In July 2002, the FAA issued a policy statement explaining the benefits of RNP and committing the FAA to developing a plan to establish public RNP airspace and procedures in U.S. domestic airspace by July 2003. In August 2002, the FAA issued an advisory circular that establishes the standards for RNP approaches and landings.<sup>8</sup>

RNP concepts have been implemented within the airspace of several countries, as well as some areas of oceanic airspace (see Reduced Oceanic Horizontal Separation Minima in this chapter). Currently, use of RNP by United States operators is limited to international operations in RNP airspace, and domestic special procedures commissioned by particular airlines. Alaska Airlines flies an RNP RNAV approach to Juneau and six other Alaskan Airports, allowing flights to land or take-off under weather conditions that would have required flights to be delayed or rerouted in the past. Aircraft flying the approach have unique equipage requirements, such as dual GPS receivers, inertial navigation systems coupled to a flight director or autopilot, and use of a color weather radar display in ground-mapping mode.

# 5.2.2 Area Navigation Approaches

RNAV approaches increase airport throughput by allowing airplanes to safely navigate landings in sub-optimal weather conditions. The development of RNAV approaches contributes to opening smaller airports to larger volumes of air traffic, which may alleviate some of the pressure on large, busy airports. RNAV approach charts can currently contain up to four approaches with differing minima. They are the LNAV (lateral navigation), LNAV/VNAV (lateral navigation/vertical navigation), LPV (localizer performance with vertical guidance), and circling.

The LNAV approach is a non-precision approach that can be conducted with approach-certified GPS receivers. As of April 2002, the FAA had published 2,884 LNAV approaches at general aviation airports, of which 37 percent are at airports with no vertically-guided instrument approaches and no previous straight-in instrument approach capability.

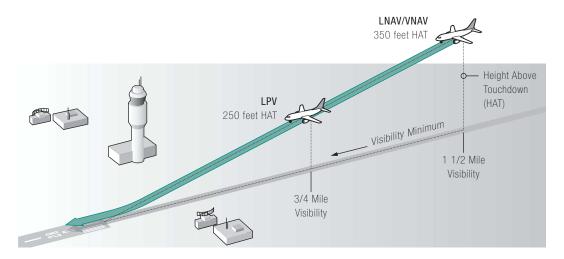
The LNAV/VNAV procedure is an approach procedure with vertical guidance that falls between a conventional non-precision approach and a true precision approach. LNAV/VNAV approaches have the lateral accuracy associated with non-precision approaches, but also have a stable, guided vertical path that leads to the runway aim point. They allow a more stable and reliable descent path than traditional non-precision instrument approaches. LNAV/VNAV approaches typically have a decision altitude of 350 feet or higher above the runway touchdown point, and require the aircraft to be equipped with an approved barometric-VNAV system or a Wide Area Augmentation System (WAAS) certified receiver. The FAA has published approximately 350 LNAV/VNAV procedures, and expects to have 700 LNAV/VNAV procedures available when WAAS is commissioned in 2003. Certified WAAS receivers are expected to become available in 2003.

LPV approaches will use WAAS to open up more runways to 250-foot ceiling and three-quarter mile visibility minimums (Figure 5-8). The LPV approach provides lateral guidance that is equivalent to or better than an instrument landing system (ILS) localizer, and vertical guidance that is only slightly less accurate than an ILS. The FAA expects to

<sup>8</sup> AC 120-29A Criteria for Approval of Category I and Category II Weather Minima for Approach.

publish its first LPV procedures in September 2003, and an additional 300 LPV approaches per year thereafter. An important benefit of LPV will be bringing vertically-guided instrument procedures to several thousand runways that would normally not have an instrument approach, many which serve general aviation users. LPV approaches will attain 250 feet and 3/4 mile visibility at approximately 80% of the runways in the NAS, while LNAV/VNAV reach the same minima at only 20 percent of the runways.<sup>9</sup>

Figure 5-8 Typical Decision Altitude and Visibility Minimums for LNAV/VNAV and LPV Approaches



Since the inception of GPS, the number of RNAV approach procedures has increased steadily. By the end of FY 2002, 3,584 RNAV approaches had been developed and published—up from 44 in 1995 (Figure 5-9). The FAA plans to develop and publish between 700 and 800 RNAV approaches (LNAV, LNAV/VNAV, and LPV combined) per year through FY 2007. The FAA projects that by 2007 all public use paved runways will have RNAV approaches. A national RNAV development prioritization can be found at the following FAA website (http://avn.faa.gov/index.asp?xml=nfpo/production). The procedure development schedule can be searched by fiscal year (2001-2006) or by region.

**Figure 5-9** RNAV Approaches Published in the U.S. (1995-2001)

Fiscal Year	New RNAV Approaches	Cumulative RNAV Approaches
1995	44	44
1996	339	383
1997	585	968
1998	516	1,484
1999	531	2,015
2000	504	2,519
2001	447	2,966
2002	618	3,584

<sup>9</sup> Navigation and Landing Transition Strategy, FAA, August 2002.

#### 5.3 Reduced Separation Minima

Separation standards, also referred to as separation minima, are being reduced incrementally in various regions to take advantage of technological advances that improve the accuracy and timeliness of position information available to pilots and air traffic controllers. Vertical and horizontal separation minima have been already been reduced in large portions of oceanic airspace, and the reduction of vertical separation minima for U.S. domestic airspace is in the planning stages.

# 5.3.1 Reduced Vertical Separation Minima

Procedures implemented more than 40 years ago required a 2,000-foot minimum vertical separation between IFR aircraft operating above Flight Level<sup>10</sup> (FL) 290, but only 1,000-foot separation below FL290. The 2,000-foot separation above FL290 was necessary because the instruments used to measure aircraft altitude at that time had relatively poor accuracy at higher altitudes. The 2,000-foot minimum vertical separation restricts the flight levels available at FL290 and above to six. During peak periods these flight levels can become congested. Over the past several years, the U.S. and other nations, in cooperation with the International Civil Aviation Organization (ICAO) and international air carriers, have reduced vertical separation minima from 2,000 feet to 1,000 feet in selected airspace.

The goal of this initiative, called Reduced Vertical Separation Minima (RVSM) is to increase airspace capacity and to allow more aircraft to operate at fuel-efficient altitudes. Implementation of RVSM makes six additional flight levels available (Figure 5-10). In the RVSM environment, aircraft are more likely to receive their requested altitude and route, because more aircraft can be accommodated on the most time- and fuel-efficient tracks or routes available. RVSM also gives air traffic controllers greater flexibility in re-routing traffic around storms, and enabling aircraft to cross-intersecting flight paths above or below conflicting traffic.

To ensure that aircraft will be able to maintain separation, aircraft that want to participate in RVSM must meet stringent altimetry system standards. Aircraft that are approved for RVSM are eligible to conduct RVSM operations worldwide. Approximately 22 percent of flights in U.S. airspace are already conducted by aircraft that have been approved for RVSM operations.

<sup>10</sup> Flight Level is a level of constant atmospheric pressure stated in three digits that represent altitude in hundreds of feet. For example, Flight Level 250 represents a barometric altimeter indicator of 25,000 feet.

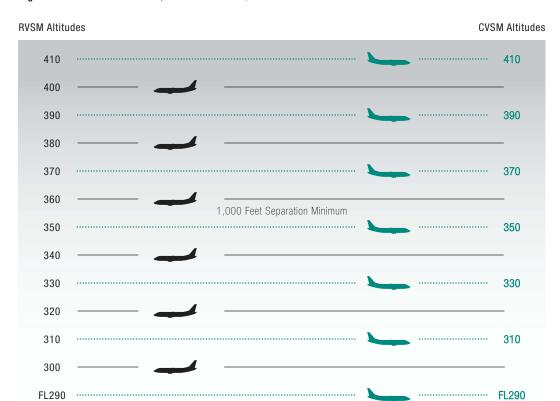


Figure 5-10 Reduced Vertical Separation Minima to 1,000 Feet

RVSM is being phased in by altitude and airspace region. It has been implemented in oceanic airspace in the North and South Atlantic, the Pacific, the South China Sea, and in the portion of the West Atlantic Route System (WATRS) that is in the New York Oceanic Flight Information Region (FIR). Since RVSM is in its early stages in many of these areas, benefits can only be estimated. In the North Atlantic airspace, introduction of RVSM resulted in elimination of 50 percent of the fuel penalty attributed to inefficient track design and cruise level, and traffic congestion. The implementation of RVSM worldwide is illustrated in Figure 5-11.

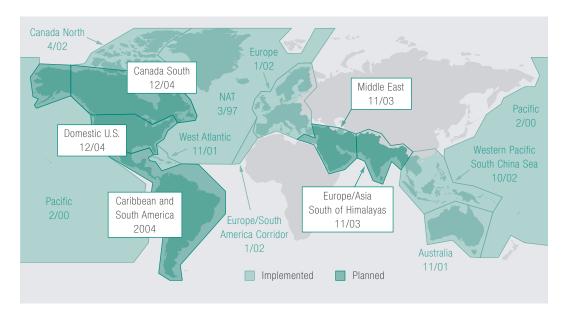


Figure 5-11 RVSM Implemented and Planned

# 5.3.2 U.S. Domestic Reduced Vertical Separation Minima

In May, 2002 the FAA issued a notice of proposed rulemaking that would implement RVSM in domestic U.S. airspace in December 2004. The new separation standards would apply to the 48 contiguous states, Alaska, and portions of the Gulf of Mexico, from FL 290–410 inclusive.

FAA data indicate that about 13,500 planes now operate between FL290 and FL410. So far, about 3,600 planes, including 1,600 airliners, are RVSM-certified. Under the proposed rules, aircraft that are not RVSM-certified will be able to transition through but not cruise in U.S. DRVSM airspace. Airplanes that are not yet RVSM-certified when DRVSM goes into effect will be handled at lower or higher altitudes. The FAA forecasts that DRVSM will save operators \$5.8 billion in fuel costs over 15 years, including \$371 million in the first year of the program.

The comment period for the U.S. DRVSM rule expired on August 8, 2002. The airline industry reiterated support for DRVSM, but operators and manufacturers of small jets say the rule would impose unacceptable aircraft modification costs, and to minimize its impact, it should be phased in gradually. The Air Transportation Association (ATA) noted in its comments that domestic U.S. airspace will be the "last large block of dense-traffic airspace" to receive RVSM benefits. RVSM has already been implemented in the continental airspace of Australia and Europe, and northern Canada. Canada is planning to implement RVSM in southern Canadian airspace at the same time that it is implemented domestically in the U.S. ATA agreed that a single-phase conversion, as was done in Europe, is the best way to implement, but suggested that the conversion date be postponed until January 2005, after the holiday peak in air traffic. Charter operators reiterated concerns about the equipage costs. One noted that the retrofit would create serious and unacceptable financial and operational hardship. Without the new equipment, they would have to fly below level 290, resulting in higher fuel burn and more financial consequences. The final rule on domestic RVSM implementation will be published in June 2003.

#### 5.3.3 Reduced Oceanic Horizontal Separation Minima

The current oceanic air traffic control system uses filed flight plans and position reports to track an aircraft's progress and ensure that separation is maintained. Position reports, sent by pilots over high frequency radio through a private radio service that relays the messages to the air traffic control system, are infrequent (approximately one per hour). Radio communication is subject to interference, disruption, and delay because radio operators are required to relay messages between pilots and controllers. These deficiencies in communications and surveillance have necessitated larger horizontal separation minima for aircraft flying over the ocean out of radar range. But with the improved navigational capabilities made possible by technologies such as the global positioning system (GPS) and controller pilot data link communications, both lateral and longitudinal oceanic horizontal separation standards are being reduced.

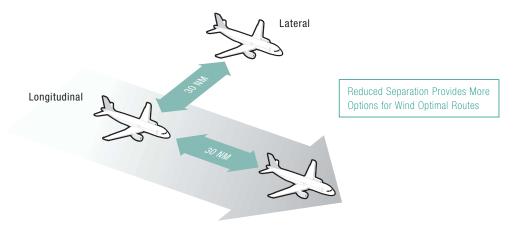
Allowing properly equipped aircraft to operate at reduced oceanic separation will enable more aircraft to fly optimal routes, reducing the time required for the oceanic leg of the flight. Reduced separation laterally may provide space for additional routes to current destinations or new direct markets. Reduced longitudinal (nose-to-tail) separation will provide more opportunity to add flights without a delay or speed penalty.

Oceanic lateral separation standards were reduced from 100 to 50 nautical miles in the Northern and Central Pacific regions in 1998 and in the Central East Pacific in 2000 (for aircraft that are RNP-10 approved). The FAA plans to extend the 50 nautical mile separation standard to the South Pacific. Because flights along the South Pacific routes are frequently in excess of 15 hours, the fuel and time-savings resulting from more aircraft flying closer to the ideal wind route in this region are expected to be substantial.

In addition, there are plans to reduce oceanic lateral and longitudinal separation minima to 30 nautical miles in portions of the South Pacific airspace by 2005 (accelerated from the initial plan for 2006) (Figure 5-12). These reduced separation minima will only apply to aircraft with sufficiently accurate navigation equipment (RNP-4),<sup>11</sup> controller to pilot data link communication, and enhanced surveillance capabilities provided by automatic dependent surveillance.

<sup>11</sup> RNP-4 approved aircraft are equipped with navigation systems that can navigate within 4 miles of desired position with 95% probability.

Figure 5-12 Reduced Oceanic Lateral and Longitudinal Separation Minima (Proposed)



#### 5.4 Increasing Civilian Access to Special Use Airspace

The FAA routinely works with the Department of Defense (DoD) to provide civilian access to special use airspace (SUA) when it is not being used by the military, through agreements concerning civilian access to specific SUA and the development of automated information systems that report on the availability of SUA. Since September 11, 2001, both agencies have increased their efforts to ensure efficient coordination because of the increased number of military operations. More frequent military involvement, especially near large metropolitan areas, adds an additional, unpredictable congestion factor. The FAA and the military have continued to improve their communications systems to facilitate civilian use of SUA when it is not being used by the military. These coordination activities include the following:

- > At the Palatka Complex in Florida, Restricted Area-2906 was scheduled for general aviation access 24 hours per week in early 2001. Based on its initial success, weekend hours of access were expanded.
- ➤ In Florida, the Jacksonville Center and the Navy Fleet Area Control and Surveillance Facility have initiated an airspace coordination process using a flight-planning tool developed by the Air Force. Using the software, either facility can depict airspace and transmit the data to the other. This enhances the flow of civilian traffic with a minimal impact on Navy flight operations.
- ➤ In cooperation with DoD, the FAA has developed a computer information system, the Special Use Airspace Management System (SAMS) to provide pilots, airlines, and controllers with the latest status information, current and scheduled, on special use airspace. DoD operates the Military Airspace Management System (MAMS), which gathers information about SUA scheduling and transmits this data to SAMS. These two systems, working in concert, ensure that the FAA and system users have access to daily information on SUA availability on the internet. A prototype system called Special Use Airspace/In-Flight Service Enhancement would be used to disseminate graphic depictions of near-real time SUA information to airlines and GA users.

➤ The FAA has begun to include VFR waypoints on sectional and terminal charts, which can be used to help VFR pilots navigate around special use airspace. The waypoints help pilots using GPS for supplemental navigation by allowing them to fly from point-to-point and navigate around special use airspace and other restricted or congested airspace.

#### 5.5 Approaches to Closely-Spaced Parallel Runways

At airports with closely-spaced parallel runways, capacity is constrained in low-visibility conditions. When visibility is good pilots can conduct simultaneous visual approaches to closely-spaced parallel runways. But during periods of low visibility, simultaneous approaches to closely-spaced parallel runways monitored by conventional airport surveil-lance radar are not permitted. For parallel runways separated by 2,500 feet to 4,300 feet, two arrival streams can be maintained but operations are limited to parallel dependent instrument approaches using 1.5 mile staggered separation. For parallel runways spaced less than 2,500 feet apart, operations are restricted to one arrival stream, which effectively reduces the airport's arrival capacity to one-half of its capacity in visual meteorological conditions. To help reduce the negative effect of weather on arrival capacity, the FAA has developed several approach procedures that take advantage of the enhanced surveillance capability of the precision runway monitor (PRM).

# 5.5.1 Precision Runway Monitor

The PRM is a surveillance radar that updates essential aircraft target information 4 to 5 times more often than conventional radar equipment. PRM also predicts the aircraft track and provides aural and visual alarms when an aircraft is within ten seconds of penetrating the non-transgression zone. During PRM approaches to closely-spaced parallel runways, a separate controller monitors each runway. Use of the PRM allows air traffic controllers to ensure safe separation of aircraft on the parallel approach courses and maintain an efficient rate of aircraft landings during adverse weather conditions. All pilots must complete special training before they are authorized to conduct a simultaneous ILS PRM approach to closely-spaced parallel runways.

In December 2001, the FAA determined that the Traffic Alert and Collision Avoidance System (TCAS) may be operated in the resolution advisory (RA) mode when conducting a PRM approach. Previously, the FAA had required pilots to turn off the TCAS RA during a PRM approach to avoid the possibility of conflict between the RA and an air traffic controller's instruction. In the rare event of a simultaneous TCAS RA and controller breakout instruction, the pilot should immediately respond to the RA and comply with the turn portion of the ATC breakout instruction. If following a RA requires deviating from an ATC clearance, the pilot should advise ATC as soon as possible.

The FAA has commissioned PRMs at Minneapolis and St. Louis, and most recently, at Philadelphia International Airport in September 2001. PRM's are scheduled for commissioning at San Francisco and John F. Kennedy in late-2002, Cleveland in late-2004, and Atlanta in 2006, coincident with the completion of the fifth parallel runway. The FAA has approved the following procedures using a PRM to allow simultaneous instrument approaches in adverse weather.

- ➤ Simultaneous instrument approaches for 4,300 feet-3,400 feet spacing (applicable to Minneapolis).
- ➤ Simultaneous instrument approaches down to 3,000 feet spacing with one instrument landing system (ILS) localizer offset by 2.5-3 degrees (Philadelphia and proposed for JFK).
- ➤ Simultaneous offset instrument approaches (SOIA) for parallel runways spaced at least 750 feet apart, and less than 3,000 feet apart at airports identified by the FAA (proposed for SFO).

In June 2002, Philadelphia began using its PRM to conduct simultaneous approaches to its parallel runways spaced 3,000 feet apart. Air traffic controllers can use this procedure to direct slower moving aircraft to the north runway, and the faster jets to the south parallel runway. The SOIA procedure, which has been developed but not yet implemented, is discussed in more detail in the following section.

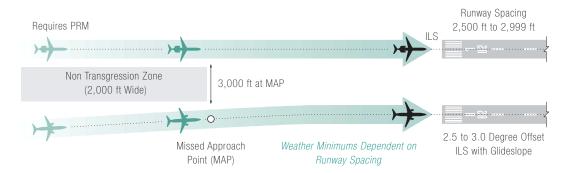
#### 5.5.2 Simultaneous Offset Instrument Approaches

The SOIA procedure would allow simultaneous approaches to parallel runways spaced from 750 feet to 3,000 feet apart. It requires the use of a PRM, a straight-in ILS approach to one runway, and an offset localizer directional aid (LDA) with glide slope approach to the other runway (Figure 5-13).

The SOIA concept involves the pairing of aircraft along adjacent approach courses separated by at least 3,000 feet with a designated missed approach point approximately 3.5 nautical miles from the runway threshold. The pilot on the offset approach would fly a straight-but-angled approach until descending below the cloud cover. At that point, the pilot would have a period of time to visually acquire the traffic on the other approach before continuing to the runway. If the pilot does not see the other aircraft before reaching the missed approach point, the approach would be discontinued.

San Francisco International Airport (SFO) and Lambert-St. Louis International Airport (STL) are the first candidate airports for SOIA. At SFO the arrival rate is 60 aircraft per hour in clear weather using both parallel runways, which are 750 feet apart. In times of heavy fog and low-ceiling conditions, aircraft are placed in-trail to one runway, reducing the airport arrival rate by half. The SOIA procedure will enable SFO to maintain an arrival rate of up to 40 aircraft per hour with a cloud base as low as 1,600 feet and four miles visibility. The FAA has completed flyability, collision risk, and preliminary wake turbulence analyses for the SOIA procedure, but the PRM has not yet been commissioned. At STL, the parallel runways are approximately 1,300 feet apart. PRM-SOIA procedures are expected to be operational in 2003 for both sites. Other potential sites for SOIA include Newark, Cleveland, and Miami airports.

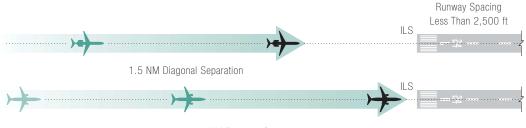
Figure 5-13 Simultaneous Offset Instrument Approach



# 5.5.3 Along Track Separation

Along track separation is a proposal to increase arrivals to parallel runways spaced less than 2,500 ft. apart in periods of low visibility. The procedure entails parallel dependent instrument approaches staggered down to 1.5 nautical miles diagonally (Figure 5-14). The relevant safety analyses have not yet been conducted to determine whether a PRM would be required for this procedure to ensure safe separation.

Figure 5-14 Along Track Separation



1.5 NM Diagonal Separation can be Used to Lowest Approved Weather Minimums



CHAPTER 6

# CHAPTER 6 AIRSPAGE REDESTIGN

# 6 Airspace Redesign

The growth of aviation traffic in the past decade has placed increasing demands on the FAA to enhance airspace capacity. When airport congestion exacerbates airspace congestion, controllers respond by initiating restrictions such as en route holding of aircraft and miles-in-trail restrictions to moderate the flow of aircraft into terminal areas. In addition, at many airports, flights must funnel through common arrival or departure fixes, which reduces throughput rates due to the large number and types of aircraft with varying performance characteristics using the same airspace.

The FAA is reviewing the structure of the nation's airspace and redesigning it to improve throughput and provide user flexibility, consistent with evolving air traffic and avionics technologies. This umbrella airspace initiative, referred to as National Airspace Redesign, encompasses several regional redesign efforts. In addition, the recently completed National Choke Points initiative focused on short-term solutions to problems in chronically congested airspace in the Northeast, and the high-altitude redesign project is addressing congestion in en route airspace.

FAA airspace planners are using various approaches to increase airspace capacity and minimize the need for air traffic restrictions, including re-sectorization, consolidating and expanding terminal airspace, and developing area navigation routes. Sectorization is the processes whereby the FAA divides the airspace into appropriately-sized and -shaped volumes that facilitate safe and orderly traffic flows and provides a manageable level of work for the air traffic controllers assigned to each sector. Consolidating terminal airspace reduces the amount of coordination required to handle arriving and departing aircraft, and expanding it frequently allows controllers to begin to reduce aircraft spacing further out from the airport. The development of RNAV arrival and departure procedures allows more efficient use of constrained terminal airspace, because arrival and departure streams can be closer together than those governed by ground-based navigation aids.

#### 6.1 The National Choke Points Initiative

In 2002, the FAA completed the 2-year National Choke Points initiative. This initiative focused on short-term actions to improve air traffic flow at seven problem areas located in the highly traveled airspace "triangle" between Chicago, Washington, D.C., and Boston. This area includes many of the country's major population areas and its most congested airports.

The FAA used a combination of techniques to successfully alleviate the choke points. The most common approaches were reorganizing existing sectors, creating new sectors, and adjusting controller staffing accordingly. In all, 19 new sectors were created. In addition, the FAA modified aircraft routes, and separated slower traffic to facilitate smooth flow. The choke point initiative has succeeded in reducing delays in these areas by an average of 23 percent. Examples of steps that were taken to address choke points are described below.

> Cleveland Center airspace has historically been complex and difficult to manage because of the proximity of Detroit, Cleveland, Pittsburgh, and Cincinnati airports, and the significant traffic in the New York to Chicago corridor. To address these issues, several sectors were realigned and three new sectors were opened. For example, in November 2001, a new sector called Geauga Sector "Ultra-High"

was created to relieve the pressure in this area by stratifying existing sectors at FL370 and above (Figure 6-1). Another sector, Dansville, was split horizontally to streamline the east-west flow of traffic between New York and Boston Centers to Chicago, and airports within Cleveland Center airspace. In the Pittsburgh area, the Clarksburg Sector was opened as part of a several sector reconfiguration designed to reduce the complexity of traffic in that area. This change benefited traffic destined to Philadelphia, Washington, Baltimore, and Cleveland.

➤ In Washington center airspace, arrival flows from the south into Newark and LaGuardia, had previously passed through narrow sectors on crossing flight paths. In December 2001, the FAA reversed or "flip-flopped" routes to LaGuardia and Newark airports, which created parallel flight paths to replace the crossing flight paths (Figure 6-2). During the first few months of use, the flip-flop allowed controllers to reduce miles-in-trail restrictions and reduced delays on both approaches. In addition, the adjustment has reduced the noise impact in some communities under the Newark arrival path.

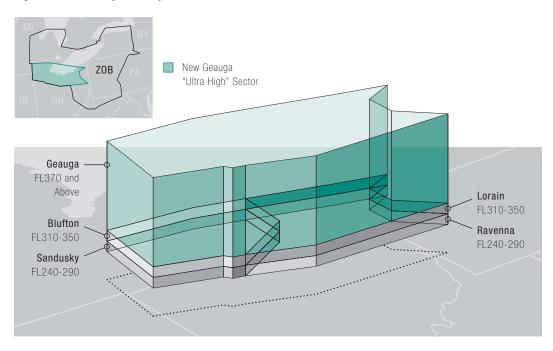
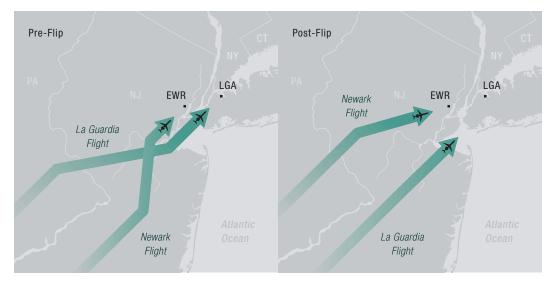


Figure 6-1 New Geauga "Ultra High" Sector in Cleveland Center

Figure 6-2 "Flip-Flop" of Routes into Newark and LaGuardia Airports



# 6.2 High Altitude Airspace Redesign

High-altitude redesign focuses on efficient flow of en route operations. Currently, aircraft that are flying near or across sector boundaries are frequently delayed as they are handed off from one air traffic control facility to another. The objective of high altitude airspace redesign is to allow users to fly preferred routes and altitudes with fewer restrictions and delays than the present system requires. The airspace above FL350 will be redesigned to allow this flexibility with minimal constraints.

Current procedures to separate traffic require longitudinal separation of five miles in en route airspace. When two aircraft are flying along the same airway, they are kept in trail, one behind the other, which can delay the trailing plane. If the two aircraft are heading for different airports, it should be possible for them to fly on parallel routes, maintaining safe separation but enabling both to operate at optimal speed. Parallel routing will reduce the inefficiencies and workload created by placing aircraft in trail as the primary means of providing structure and controlling volume.

The FAA has created a high-altitude program office to develop high-altitude alternatives. Preliminary high-altitude airspace modifications for the northwest portion of the country are being modeled, with initial implementation planned for 2003. This first phase uses parallel RNAV routes in high-traffic and confined airspace and navigation waypoints for tactical navigation around weather and special use airspace.

The Great Lakes Corridor En Route Redesign project is another FAA project with a high-altitude redesign component. In the Great Lakes region (including Chicago, Minneapolis, Indianapolis, and Chicago centers), many sectors regularly impose miles-intrail restrictions to mitigate sector saturation or complex workload. This project will focus on reducing sector complexity, procedural and automation enhancements to reduce restrictions, routing through special use airspace when available, and development of RNAV routes.

# 6.3 New York/New Jersey/Philadelphia Metropolitan Redesign Project

More passengers and planes fly in and out of the New York/New Jersey/Philadelphia metropolitan area than any other area in the U.S. This area services more than 8,000 flights per day, and more than 99 million passengers per year. The metropolitan area airports and their terminal airspace were not designed to handle this volume of traffic and as a result, several of them are among the most delayed airports in the U.S.

The proximity of these airports to one another results in complex pilot/controller and controller/controller coordination and circuitous flight paths. The complex flow patterns make it difficult for controllers to reroute flights from an overloaded arrival fix to a less loaded fix, which consequently results in aircraft being placed into a holding pattern. Holding is used to maximize utilization at an arrival airport by maintaining a line of holding aircraft near the airport. The constant availability of arriving aircraft allows airlines to use arrival slots as soon as they become available. If there are no aircraft near the airport waiting to fill slots as soon as they open, arrival capacity is wasted. Due to the high volume of traffic and the limited holding capacity near the metropolitan area, much of the airborne holding for New York area airports occurs outside of the New York Center.

The FAA is in the early stages of redesigning the airspace in the New York/New Jersey/Philadelphia Metropolitan area. The FAA is in the process of designing alternatives to relieve airspace congestion generated by Newark, Kennedy, LaGuardia, Philadelphia and several regional and general aviation airports. The alternatives address traffic in the airspace currently controlled by the New York TRACON, roughly a 50-mile radius around the TRACON.

One alternative would modify existing traffic patterns principally by the creation of RNAV routes. The number of routes into and out of the New York TRACON is limited today by current radar technology. The increased navigational capabilities offered by advanced navigational systems such as flight management systems and the global positioning system would allow the creation of RNAV routes that can be spaced closer together than existing routes. This would increase throughput, while reducing delays and flight.

Another alternative, referred to as the Four Corner Concept, would establish four arrival areas around the metropolitan area. Once aircraft overfly the corner fix, they could proceed directly to the destination airport, or to another corner, or enter into a large overhead circular pattern to await final sequencing into their ultimate destination airport. Aircraft in the circular pattern would be stacked at different altitudes to accommodate large quantities of aircraft in the metropolitan area. Departing aircraft would be routed between the four arrival areas.

The Ocean Routing Concept is focused on departure procedures for EWR, but affects JFK and LGA flight procedures as well. Under this concept, Newark departures from the south runways (22L/R) would be routed eastbound over the Atlantic, regardless of their destination. Aircraft would turn back toward their destinations after gaining altitude to reduce the impact of aircraft noise on the underlying communities.

In addition, another "clean sheet" approach is being explored. The airspace redesign team is in the process of finalizing the alternatives. Once the alternatives are complete, the environmental analysis will begin, including noise modeling.

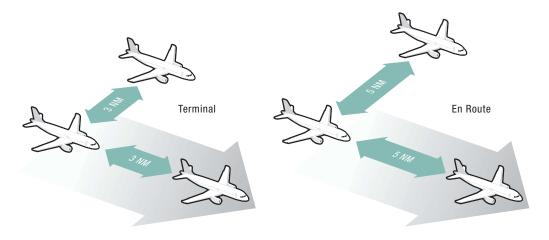
# 6.4 Phoenix Airspace Redesign

In February 2002, the FAA introduced airspace and procedural changes for flights serving Sky Harbor and other Phoenix-area airports. These changes are an element of Northwest 2000, which seeks to optimize the airspace controlled by the Phoenix TRACON and the nearby high-altitude airspace controlled by the Albuquerque Center. The redesign of Phoenix airspace is based on conventional procedures (using radar vectoring) in the initial phases, with introduction of RNAV procedures over time. On a recent test flight into Phoenix using an RNAV arrival route, the aircraft saved approximately four minutes of flight time.

# 6.5 Consolidation of Terminal Airspace Control

Typically, a TRACON controls aircraft within 5 and 50 miles of an associated airport. In metropolitan areas with several airports, the terminal airspace of adjacent airports may overlap, creating a complicated airspace structure. In these circumstances, consolidating two or more TRACONs into a single facility can simplify that airspace structure. The consolidation improves communications among controllers handling operations over a wide geographic range and increases their flexibility in merging, maneuvering, and sequencing aircraft to and from the area airports. Additional flexibility can be gained by bringing portions of en route airspace under TRACON control, especially where comprehensive radar coverage allows three-mile spacing rather than the five-mile spacing that is customary in the en route environment (see Figure 6-3). Examples of ongoing FAA efforts to consolidate airspace control are the Potomac Consolidated TRACON (PCT), the Northern California TRACON (NCT), and the New York Integrated Control Complex (NYICC). The PCT and NCT primarily involve consolidating the airspace of several TRACONs, with the addition of relatively small areas of en route airspace. The NYICC would bring large amounts of en route airspace under TRACON control.

Figure 6-3 En Route vs. Terminal Aircraft Spacing



#### 6.5.1 Potomac Consolidated TRACON

The Potomac Consolidated TRACON (PCT) consolidates the radar operations of five airports serving the Washington Metropolitan Area: Andrews Air Force Base (ADW), Baltimore-Washington International Airport (BWI), Dulles International Airport (IAD), Richmond International Airport (RIC) and Washington National Airport (DCA). The building is complete and is schedule to be commissioned in late 2002.

The PCT will have continuous radar coverage from south of Richmond, Virginia to north of Philadelphia, Pennsylvania, and from as far west as Cumberland, Maryland and east to Cambridge, Maryland. The PCT will gain control of several pieces of airspace that are currently controlled by the en route centers. The expanded and consolidated terminal area airspace will allow the PCT modify aircraft routes and altitudes to handle inbound and departing aircraft more efficiently. The FAA developed several alternative airspace structures for taking advantage of the consolidated TRACON airspace. Each of the alternatives includes a significant redesign of PCT airspace, but require varying degrees of coordination and transfer of control with adjacent facilities.

One alternative under consideration for more efficient traffic flow into the Washington/Baltimore area incorporates RNAV routing. Under this alternative, a ring of fixes around the Baltimore/Washington area could be implemented to allow direct routing to and from major cities. Another alternative would establish four arrival and departure areas around the Baltimore/Washington area. A third alternative would maintain most of the existing ingress and egress points into the PCT airspace, while removing the intra-TRACON boundaries and related constraints of the existing airspace structure. This alternative is considered low risk from the viewpoint of implementation because it would not significantly affect the airspace structure of ATC facilities adjacent to PCT airspace. The FAA plans to name its preferred alternative in early 2003.

# 6.5.2 Northern California TRACON

In August 2002 the FAA began transferring air traffic control responsibilities from four existing TRACONs in Northern California (Oakland, Monterey, Sacramento, and Stockton) to the NCT. The transfer of operations will be done in four phases, starting with Sacramento, and ending with Oakland in 2003. When fully commissioned, the NCT will monitor flights in and out of more than 20 airports. The FAA is evaluating airspace alternatives that will take advantage of the operational advantages of the co-located facilities.

# 6.5.3 New York Integrated Control Complex

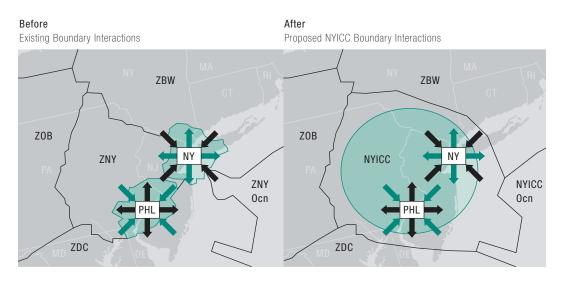
The New York Integrated Control Complex (NYICC) concept emerged from the National Airspace Redesign Team's efforts to optimize airspace and procedures in the New York City-New Jersey-Philadelphia area. The NYICC would potentially integrate terminal airspace from the New York TRACON with portions of the airspace currently controlled by adjacent TRACONs and centers abutting the New York TRACON (Figure 6-4).

Expanding the New York TRACON airspace would reduce the fragmentation of arrival and departure corridors across multiple centers, which currently limits the flexibility to address the dynamic nature of the northeast corridor traffic flows. Bringing portions of en route airspace under terminal control will provide additional airspace to support a more even balance of arrivals among arrival fixes and holding patterns within the TRACON.

Capacity benefits will include reduced delays, reduced restrictions, and enhanced operations during severe weather events.

In 2002, the FAA conducted a human factors analysis of arrival and departure flows involving controllers from the New York TRACON and New York center. Three scenarios were modeled: the current conditions (separate facilities, standard procedures); collocation of TRACON and center controllers so they could observe each other's displays and coordinate face-to-face; and use of less restrictive terminal separation procedures by the en route sector handing-off or receiving traffic to/from the New York TRACON. Preliminary results were supportive of the proposed concepts.

Figure 6-4 NYICC Concept of Operations



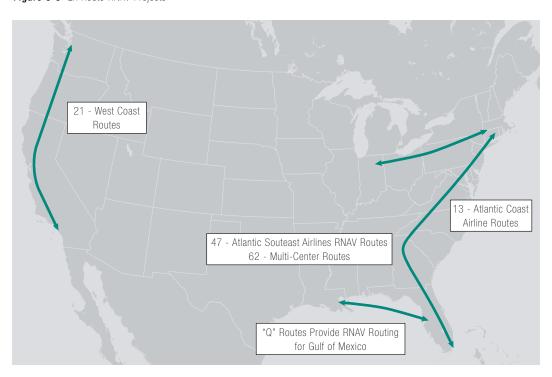
# 6.6 En Route RNAV

One of the limiting factors of the present-day NAS is that aircraft must generally follow airways that are based on a system of ground-based navigational aids. Following those airways involves flying from one navigational fix to another, connecting a series of doglegs, which increases the distance flown and the time required to do so. This is changing with the development of advanced RNAV routes. RNAV routes allow an aircraft to fly a more direct route. In 2001, airlines flying RNAV routes reported a savings of approximately \$31.2 million as a result of time and fuel savings (Figure 6-5). Several recent RNAV route development initiatives are described below.

➤ In the Southern Region, the FAA has developed 62 multi-center RNAV Routes. Delta is the principal user of 44 routes (flying between Atlanta, Georgia and various Florida cities). Eight of the routes were developed specifically for business jets flying from satellite airports. Delta projects an annual savings of approximately \$3 million from utilizing these routes. US Airways is the principal user of 18 multi-center routes between Charlotte, North Carolina and South Carolina, Georgia and Florida and they estimate annual savings of approximately \$2 million as the result of these routes.

- ➤ Atlantic Southeast Airlines operates 47 RNAV routes in the Southern Region, which are projected to generate approximately \$2 million in savings for the airline.
- ➤ Since September 2001, Texas to South Florida "Q" routes provides RNAV routing for the Gulf of Mexico (Figure 6-6). These routes are only available to operators equipped for RNAV systems approved for IFR navigation. The routes generate an estimated \$22 million in user savings per year as a result of more direct flights. Continental Airlines reported saving 5 minutes per flight on the new routes. The development of these routes also allowed military warning areas in the Gulf to be redesigned to allow increased training on the next generation of fighter aircraft. Several RNAV routes through the Gulf of Mexico connecting North America to Mexico and South America have also been proposed.
- ➤ As of September 2002, the Western-Pacific and Northwest Mountain Regions have developed 21 RNAV routes between key cities. The cities include Seattle, Portland, and Vancouver in the Pacific Northwest, and Los Angeles, San Francisco, San Jose, Oakland, Ontario, Palm Springs, John Wayne-Orange County, Las Vegas, and Phoenix in the Western-Pacific Region. The RNAV routes were developed in conjunction with Alaska Airlines as the lead carrier. The objective of these routes is to provide a seamless RNAV departure, en route, and arrival between the selected airports for all appropriately equipped RNAV aircraft. Alaska airlines project its annual savings as a result of these direct routes to exceed \$800,000.

Figure 6-5 En Route RNAV Projects



HRV

Gulf of Mexico

Gulf of Mexico

Military Airspace

Figure 6-6 RNAV Routes in the Gulf of Mexico

# 6.7 RNAV Arrivals and Departures

RNAV allows for the creation of arrival and departure routes that are independent of existing fixes and navigation aids, and provides multiple entries to existing Standard Terminal Arrival Routes (STARs) and multiple exits from Departure Procedures (DPs). Airports with multiple runways or with shared or congested departure fixes benefit the most from segregating departures and providing additional routings. In addition, a study by MITRE/CAASD estimates that use of RNAV procedures for arriving aircraft reduces the number of pilot/controller voice transmissions required from sixteen for an aircraft guided by ATC heading vectors, to four for an RNAV procedure. The reduction in controller workload improves both safety and system efficiency.

The FAA has developed a three-phase process for the conceptualization, development, testing, commissioning, charting and use of RNAV Terminal Routes. This process provides controllers with the ability to develop new procedures and visualize them with existing traffic flows.

Approximately 40 public use RNAV Departure Procedures (DPs) and Standard Terminal Arrivals (STARS) have been implemented within the NAS. Many of these procedures are "specials" commissioned by particular airlines and subsequently converted to public use. The following is the status of several terminal RNAV projects.

- ➤ In October 2001, the Las Vegas TRACON and the Los Angeles Center implemented the 4-corner post (4CP) project, becoming the first major airport to use RNAV arrival and departure procedures for all runways. Los Angeles center has begun adjusting and testing a variety of new RNAV routes to ensure smoother transitions into and out of the terminal area.
- > In the Detroit Metropolitan Airport, Northwest Airlines has completed validation flights for a terminal RNAV STAR.

- ➤ In Philadelphia, US Airways has been flying an RNAV STAR and DP. These procedures are moving to public charting.
- > At the New York Kennedy Airport, American and Delta Airlines have been flying "SKUBY1" (an RNAV STAR).
- > At Newark Liberty Airport, Continental Airlines flies two DPs ("SELBY1" and "FILSA").
- ➤ At Washington Dulles, Atlantic Coast Airline completed flight simulator trials on a DP, which was subsequently publicly charted in 2001.





# 7 National Airspace System Modernization

NAS modernization has been designed as an evolutionary process that will sustain current NAS operations while new technologies are introduced, proven, and then deployed. This process will allow for a smooth transition from one technology to another, provide sufficient time for users to equip their aircraft with the avionics required to take advantage of the new technologies, and realistic schedules for the FAA to test, train for, and deliver services.

NAS modernization is an ongoing process that builds upon the implementation of individual projects to improve the effectiveness of the entire NAS. The events of September 11 have understandably shifted the focus of the aviation community from congestion and capacity enhancement to security. But despite the decrease in traffic in the last year and forecasts for a gradual rebound, long-term forecasts still call for a large increase in demand over the next decade. NAS modernization, and the capacity enhancement that it will provide, remains a vital task of the FAA and its partners. In this vein, important work on NAS modernization continued during the past year.

# 7.1 Wide Area Augmentation System

The Wide Area Augmentation System (WAAS) is a supplement to the basic Global Positioning System (GPS) signal that increases the accuracy, availability, and integrity of the signal. The FAA intends to provide time efficiencies and cost savings through satellite-based navigation implementation. This technology allows direct point-to-point navigation, optimum routing, and other capacity improvements. Efficiencies and savings realized by the airlines, the traveling public, and the FAA include:

- ➤ Increased air traffic control efficiencies and NAS capacity through an airspace system that is restructured to accommodate direct routings between airports, as well as reduced separation standards.
- > Reduced fuel cost to airlines and reduced travel time to the public through use of more economical air routes.
- > Reduced FAA operating costs through the potential decommissioning of part of the existing ground-based navigation system.

The WAAS signal-in-space continues to provide accuracies well within the range required by the WAAS specifications and coverage availability over most of the continental United States. Recent accomplishments include developing WAAS interference mitigation and rejection methods; developing a safety processor to meet FAA safety assurance standards; and conducting ionosphere data collection and analysis to define WAAS final operational capabilities. Proposed activities for the near future include refining WAAS performance and assessment capabilities; developing interference detection and mitigation techniques; and analyzing the impact of additional civil GPS frequencies.

WAAS is projected to become operational in 2003, providing LPV (localizer performance with vertical guidance) approach minimums of 250 feet. An important benefit of LPV will be bringing vertically-guided instrument procedures to several thousand runways that would not normally have an instrument approach, many of which serve general aviation users. Sometime between 2009 and 2015, WAAS is expected to provide ILS-like Cat I approaches to 200-foot decision altitude and one-half mile visibility at most U.S. airports.

# 7.2 Local Area Augmentation System

The Local Area Augmentation System (LAAS) is an additional augmentation of GPS that will provide highly accurate navigation signals to suitably equipped aircraft. The LAAS program was designed as a collaborative project between the FAA and the private sector. During the past year this approach has made significant advances towards the implementation and actual use of this advanced navigation and guidance system. FedEx has been the leading participant in this effort and has conducted a number of successful trials at its Memphis base. LAAS should provide the following efficiencies and cost savings:

- > An increased number of instrument approaches, extending all-weather service to a greater number of cities and reduce traffic complexity resulting from backcourse approaches and circle-to-land operations.
- > Lower landing minimum, improving on-time performance by reducing the frequency of flight disruptions such as missed approaches, diversions, delays, and cancellations.
- ➤ Increased number of approaches with vertical guidance and improving safety by reducing the risk of controlled-flight-into-terrain accidents.
- ➤ Increase navigation accuracy and flexibility and improve traffic efficiency by facilitating more effective NAS configurations and optimized fuel/time navigation solutions.

LAAS is intended to complement WAAS; the systems will function together to supply users of the NAS with seamless satellite-based navigation for all phases of flight. LAAS will be used to meet Cat I precision approach requirements at those locations where the accuracy correction signals from WAAS geostationary satellites may not be fully reliable (e.g., in mountainous areas). LAAS will also be used to meet the more stringent Category II/III requirements at selected locations throughout the U.S. LAAS will yield the extremely high accuracy, availability, and integrity necessary for Cat II/III precision approaches, at one meter or less.

#### 7.3 Standard Terminal Automation Replacement System

The Standard Terminal Automation Replacement System (STARS) is a joint FAA and Department of Defense program to replace Automated Radar Terminal Systems (ARTS) and other capacity-constrained, older technology systems at 74 FAA and up to 199 Department of Defense terminal radar approach control facilities and associated towers.

Controllers will use STARS to provide air traffic control services to aircraft in terminal areas. Typical terminal area air traffic control services include: the separation and sequencing of air traffic, the provision of traffic alerts and weather advisories, and radar vectoring for departing and arriving traffic. The system will reduce the life-cycle cost of ownership, accommodate air traffic growth, and provide for the introduction of new automation functions that improve the safety and efficiency of the NAS. One of the key features of STARS is that FAA will be able to upgrade the software to provide new air traffic control tools.

The STARS program has been significantly revised since its first definition in 1996. It was originally designed to use off-the-shelf technology, with little specialized software

development. However, in consultation with the air traffic controllers and the airways facilities maintenance technicians, who raised a number of concerns about the computer-human interface, the FAA concluded that it needed to develop a more customized system and to implement it incrementally. In March 2002, the FAA reduced the number of facilities that will be receiving STARS from 188 to 74 and changed the date to complete installation at all of those facilities from 2005 to 2008. The date for deploying the full STARS to the first location is still 2002. Limited versions of STARS are already installed in El Paso, TX; Syracuse, NY; Memphis, TN; Hartford, CT; Birmingham, AL; Albuquerque, NM; Detroit, MI; Albany, NY; and Providence, RI.

The first full STARS deployment took place at the Philadelphia terminal control facility on November 17, 2002. The FAA will use STARS to control live traffic, which is considered initial operating capability, but will retain the existing air traffic control system as a backup until the new system is formally commissioned.

#### 7.4 HOST Software Rewrite

In 1999, the hardware for the air traffic control system was successfully replaced. The HOST and Oceanic Computer Replacement program replaced the interim computers that had served the ATC system from the mid-1980s to the present. However, the basic en route center automation system, which receives, processes, coordinates, distributes, and tracks information on aircraft movements throughout the nation's airspace, is based upon the original, often modified, software. Those programs were written in a computer language, JOVIAL, that is not widely used now and therefore are difficult to upgrade to accommodate new requirements.

The FAA is developing the En Route Automation Modernization (ERAM) program to replace the current NAS software and to add the capabilities required to support NAS modernization. ERAM will provide an open standards-based system that will incorporate commercial off-the-shelf and non-developmental items as much as possible. ERAM will make it easier to integrate new capabilities into the system, reduce the training needed to maintain the system, and offer enhanced simulations. The FAA has selected a team to begin the ERAM program and the final specification is under development.

#### 7.5 Free Flight Phase 1

Free Flight Phase 1 (FFP1) Core Capabilities Limited Deployment initiative was designed to deliver early benefits of free flight to NAS users while mitigating the risks of implementing new technologies. The FFP1 program has been successfully implemented at all of its initially planned sites and has been extended to others. In addition, the new technologies are bringing real and measurable improvements, as summarized below.

#### User Request Evaluation Tool

User Request Evaluation Tool (URET) is operational at six centers: Kansas, California, Memphis, Indianapolis, Cleveland, Chicago, and Washington (Leesburg). Both facilities are providing increased direct routings to users, resulting in savings in aircraft direct operating costs of \$1.5 million per month. Also, the Indianapolis Center has eliminated more than 22 altitude restrictions, saving users nearly \$1 million per year in fuel costs. URET is being deployed at five additional centers.

# Traffic Management Advisor

The Traffic Management Advisor (TMA) is fully operational at three centers, providing metered traffic flows to the Dallas/Ft. Worth, Denver, and Minneapolis airports. In addition to more fuel-efficient flows, TMA has increased peak capacity at these airports by 2-to-5 percent. Additional TMA systems are deployed at centers feeding traffic to Atlanta, Los Angeles, San Francisco, and Miami airports, where the controllers use TMA to provide increased situational awareness, leading to more efficient traffic flows.

#### Surface Movement Advisor

The Surface Movement Advisor (SMA) was the first Free Flight Phase 1 program to be completed. Feedback from the airlines has been very positive; Northwest Airlines has estimated that it has been able to avoid three-to-five costly diversions weekly, especially during periods of inclement weather. Four additional airlines are currently using SMA data to improve operations.

# Collaborative Decision Making

Both a philosophy of traffic management and an array of computer tools that facilitate a real-time collaboration between the FAA, and the airlines, Collaborative Decision Making (CDM) provides FAA traffic flow managers and airline dispatchers with the same real-time information. It links the FAA with the dispatch systems of the airlines and provides the airlines with access to NAS data, including weather, equipment, and delays. CDM allows the FAA to manage the air traffic system more efficiently and the airlines to employ their aircraft more effectively.

# 7.6 Free Flight Phase 2

Free Flight Phase 2 (FFP2) builds on the successes of Free Flight Phase 1 to improve safety and efficiency within the NAS. FFP2 includes the east-to-west expansion of Phase 1 elements, including URET and TMA, to additional FAA facilities. FFP2 will provide incremental enhancements to URET and TMA during the period 2003-2005. FFP2 will deploy a number of additional capabilities.

One of the Phase 2 initiatives, Controller Pilot Data Link Communications (CPDLC), achieved initial daily use on October 7, 2002, in Miami Center airspace. CPDLC provides a method of communication between the air traffic control facility and the aircraft cockpit through the digital transmission of messages, eliminating a great deal of voice traffic, thereby reducing congestion on radio frequencies.

Additionally in Phase 2, the FAA (and its collaborators) will conduct selected research activities to extend certain FFP1 capabilities and to develop others. Research activities in FFP2 include the Multi-center Traffic Management Advisor, the Surface Management System, and two controller routing and conflict resolution aids, the Direct-To-Tool, and the Problem Analysis, Resolution and Ranking (PARR) function.

# 7.7 Ohio River Valley Project

The Ohio River Valley (ORV) project is a government/industry initiative to demonstrate and validate the capabilities of advanced communications, navigation, surveillance, and air traffic control procedures to increase the capacity and efficiency of the NAS. This initiative

is another step in the evolutionary process of bringing emerging technologies into the NAS. The Ohio River Valley project addresses issues connected with fielding advanced systems such as Automatic Dependent Surveillance-Broadcast (ADS-B), Controlled Flight Into Terrain (CFIT) avoidance, and the Traffic Information Service-Broadcast (TIS-B). The Ohio River Valley project evaluates the following issues:

- > Addresses pilot and controller human factors issues.
- > Develops and assesses new operational procedures and the associated training.
- > Streamlines certification processes and procedures.
- > Develops a cost-effective avionics and NAS infrastructure.
- > Defines a realistic NAS transition path that is supported by the user community

The Ohio River Valley project is testing ADS-B avionics on commercial cargo aircraft in the Ohio River Valley. These tests are taking place in terminal areas with significant cargo operations, including Memphis, Tennessee; Wilmington, Ohio; Louisville, Kentucky; Scott Air Force Base, Illinois, and Nashville, Tennessee. The Ohio River Valley Project is co-sponsored by the Cargo Airline Association (CAA) and the FAA. The CAA has purchased, equipped, and is maintaining the avionics for the test aircraft. The CAA members are conducting revenue flights with these aircraft to evaluate the systems' performance in normal operations.

The FAA has purchased, installed, and is maintaining ground systems at the five sites. A ground broadcast server has been installed at the Wilmington site that receives data from the other sites and depicts ADS-B targets fused with radar targets. As the project proceeds, fused ADS-B and radar target data will be made available to suitably-equipped aircraft to enable the pilots to see both targets on a cockpit display, along with selected broadcast information such as weather maps, special use airspace status, and wind shear alerts.

As part of the ORV project, the project has established or modified operational concepts and procedures, including departure spacing, runway and final approach occupancy awareness, and airport surface operational awareness. These initiatives are for demonstration purposes only at this time. In addition, the project installed a special Common ARTS automation system at the Louisville TRACON for evaluation by controllers in their work with airborne ADS-B applications and has installed a multilateration ADS-B surface surveillance system at Memphis in order to conduct an evaluation of surface management. That evaluation was completed in 2001.

As the ORV project continues, the FAA and the industry will share the funding of avionics and ground systems to build on ongoing industry initiatives. These include resolving ADS-B technology issues; continuing extensive data collection activities during operational evaluations; exploring the use of TIS-B and FIS-B data link messages to receive traffic and weather information in the cockpit; and developing an integrated cockpit display of terrain, traffic, and weather conditions. Throughout the project, the FAA will take special care to ensure that controllers and both commercial and general aviation pilots are included in the evaluation of operational enhancements and data link alternatives.

# 7.8 Alaska Capstone Program

The Capstone Program was established by the FAA as part of its Safer Skies initiative, in response to a National Transportation Safety Board (NTSB) safety study, Aviation Safety in Alaska, to address Alaska's high accident rate for small aircraft, which is five times the national average. A recent FAA-sponsored study estimated that 38 percent of commercial operator accidents in Alaska could be avoided if information on position relative to terrain and real-time weather information were available to pilots in the cockpit. The principal objective of the Capstone Program is to improve pilots' situational awareness of the flight environment and to thereby avoid mid-air collisions and controlled flight into terrain. Although the FAA plans to initially demonstrate the benefits of these technologies in Alaska, it will eventually consider extending those technologies to the entire NAS.

Capstone is a joint government/industry initiative designed to prototype, demonstrate, validate, and implement the capabilities of advanced surveillance systems and air traffic procedures, using Automatic Dependent Surveillance-Broadcast (ADS-B), Flight Information Services-Broadcast (FIS-B), and Traffic Information Service-Broadcast (TIS-B) as enabling technologies.

The Capstone initiative is a visible program providing tangible benefits. Capstone is building an infrastructure that is consistent with NAS modernization plans and it is identifying the transition path for procedure development and technology implementation while providing near-term safety benefits. Capstone's first priority is to improve aviation system safety in Alaska through the introduction of new communications, navigation, and surveillance technologies.

The FAA has equipped 120 commercial aircraft in a non-radar environment in the Yukon-Kuskokwim Delta region of southwest Alaska with the Capstone avionics suite. It includes a cockpit multifunction display, a GPS navigation/communications unit, a Universal Access Transceiver data link unit, and a GPS-based terrain database of Alaska. The suite enables each participating aircraft to broadcast its identification, position, and altitude, climb rate, and direction and to receive similar signals from other aircraft.

The FAA has begun the installation of a network of data-link ground stations that will transmit radar targets of non-participating aircraft to the Capstone aircraft. In addition, the ground stations will transmit flight information services, including weather reports and forecasts, maps, status of special use airspace, pilot reports, and notices to airmen. The FAA is also publishing non-precision approaches and installing automated weather observation systems at 10 village airports in the Delta region.

The initial improvements of Capstone are directed towards pilots conducting Visual Flight Rule (VFR) operations. In the future, the FAA plans to certify systems and equipment and develop enhanced operational procedures for Instrument Flight Rule (IFR) operations. When this is accomplished, ADS-B can be used for air traffic control functions just as radar is now used. Specific accomplishments of the Capstone Program in Alaska include the following:

- ➤ Initiated the use of ADS-B at the Anchorage center with a single ground-based receiver to provide radar-like services in the Bethel, AK area.
- ➤ Installed eight operational ground-based receivers in the Yukon-Kuskokwim Delta region of southwestern Alaska.

- > Installed and commissioned nine Automated Weather Observation Systems with weather cameras.
- > Published 19 first-time GPS approaches for 10 Alaskan airports.
- > Trained over 100 pilots and associated personnel on Capstone avionics.
- > Demonstrated the incorporation of WAAS technology with Capstone avionics in southeast Alaska.

Additional developments in Capstone are planned to continue through the rest of 2002 and during 2003. These include the installation of Capstone avionics in additional participating aircraft in southeast Alaska, the installation of ADS-B ground-based transceivers in Bethel and southeast Alaska, and evaluations of these and earlier actions.

# 7.9 Summary

NAS modernization continues on the successful path that has been established in the past several years. The current decline in aircraft operations gives the FAA and the aviation community a rare opportunity to accomplish many of these activities without the press of heavy congestion. Although the financial difficulties of the aviation industry may delay the equipage of some aircraft with the avionics required to take advantage of many of the FAA's NAS modernization activities, in the longer term these are likely to be accomplished, in part because many of these new technologies offer substantial near-term benefits and because they are important steps in the continuing evolution of the system to one of Free Flight.

# APPENDIX A

FUNDAMENTALS OF THE NATIONAL AIRSPACE SYSTEM

# Fundamentals of the National Airspace System

The National Airspace System is an interconnected system of airports, airways, air traffic facilities and navigational aids. These elements of the NAS are operated and supported by airport employees, air traffic controllers, technicians, airspace specialists, and others.

Airports, air traffic facilities and equipment, and navigational aids are static physical components of the NAS. Over longer periods, airports may be expanded as new runways, taxiways, and terminal buildings are built; new air traffic facilities may be built and air traffic equipment and navigational aids modernized. In contrast, the condition of the airways changes continuously, as they are affected by changing weather, winds, and traffic. This chapter describes both the static and dynamic elements of the NAS.

# A.1 Airports in the United States

Although there are more than 19,000 airports in the United States, the FAA considers only 3,364 existing airports to be significant to the capacity of the NAS. These airports are included in the National Plan of Integrated Airport Systems (NPIAS) and are thereby eligible to receive Federal grants under the Airport Improvement Program. Within the NPIAS, airports are divided into two major categories: commercial service airports and general aviation airports.

# A.1.1 Commercial Service Airports

Commercial service airports are public airports receiving scheduled passenger service and having 2,500 or more passenger enplanements. Of the 535 commercial service airports, the 401 airports that have more than 10,000 annual enplanements are classified as primary airports. Those commercial service airports enplaning from 2,500 to 10,000 passengers annually are classified as "other" commercial service airports.

Within the primary airport classification, the term hub is used to identify very busy commercial service airports. This use is different from that of the airline industry, where a hub is an airport where passengers connect with other flights coming from the spokes of the system. The NPIAS term does not differentiate between airports with mostly connecting traffic and those with mostly origin-destination traffic. The primary airports are divided into largehub, medium-hub, small-hub, and non-hub airports, based on their annual enplanements. Large-hub airports are those that account for at least one percent of total U.S. passenger enplanements. Medium hubs are airports that account for between 0.25 percent and one percent of total passenger enplanements and small hubs from 0.05 percent to 0.25 percent of total passenger enplanements. Commercial service airports that enplane less than 0.05 percent of total passenger enplanements but more than 10,000 annually are classified as non-hub primary airports.

The number of large-hub, medium-hub and small-hub airports varies from year-to-year because the classification is based on a percentage of total passenger enplanements rather than on a fixed number. For example, from 2000 to 2001, while the number of large hubs stayed the same at 31, the number of medium hubs increased from 35 to 36, and the number of small hubs decreased from 71 to 68.

Traffic in the United States is concentrated at the largest airports. The 31 large-hub airports handled 69.2 percent of passenger enplanements in 2001, the 36 medium-hub airports handled 19.8 percent, and the small hubs another 7.6 percent. Collectively, the

135 hub airports had 96.6 percent of total passenger enplanements. The remaining 266 primary airports had only 3.3 percent of enplanements, while the 134 non-primary commercial service airports had only 0.1 percent of enplanements.

# A.1.2 General Aviation Airports

The FAA classifies airports that have fewer than 2,500 annual enplanements or do not receive any scheduled commercial service as general aviation airports. They are included in the NPIAS if they account for enough activity (generally defined as having at least 10 based aircraft) and are at least 20 miles from the nearest other NPIAS airport.

The 2,829 NPIAS general aviation airports are divided into reliever and general aviation airports. Relievers are high capacity general aviation airports in major metropolitan areas that provide general aviation pilots and aircraft with attractive alternatives to using congested commercial service airports. There were 260 relievers in 2001, including important airports such as Merrill Field in Anchorage, Alaska; Teterboro Airport in New Jersey near New York City; and Van Nuys in California. The remaining 2,569 general aviation airports typically serve rural areas, and have very little, if any, commercial service.

Although relievers and other general aviation airports have little commercial service, they do have a small number of passenger enplanements, primarily provided by air taxi operators. In 2001, there were 1,999 general aviation airports that had some enplanements, but which together totaled only 0.1 percent of passenger enplanements.

# A.2 Airspace in the United States

Airspace in the United States is managed by the FAA to provide for its orderly and safe use. The NAS includes all airspace over the United States from 60,000 feet down to, but not including, the ground. Over the years, the FAA has promulgated numerous regulations that divide the airspace into different classifications and provide complex rules for operating within each classification.

# A.2.1 Classes of Airspace

The national airspace is divided into two broad categories, controlled (Classes A through E airspace) and uncontrolled (Class G airspace). Within these two categories, there are a number of classifications that determine the flight rules, pilot qualifications, and aircraft capabilities required to operate within any section of the airspace. The specific classification of any area is broadly based on the complexity and density of aircraft movements, the nature of operations conducted within the airspace, the level of safety required, and the national and public interest. The six classes of U.S. airspace are described below.

# Class A Airspace

All airspace from 18,000 Mean Sea Level (MSL) to 60,000 MSL, including the airspace overlying the waters within 12 nautical miles of the coast of the contiguous 48 states and Alaska. All operations within Class A airspace must be under Instrument Flight Rules and are under the direct control of FAA controllers. Class A airspace always starts at 18,000 MSL and it is not specifically charted.

# Class B Airspace

Airspace surrounding the nation's busiest commercial service airports. At its core it extends from the surface up to 10,000 MSL. Class B airspace is charted on sectional charts, IFR en route (low altitude) charts, and terminal area charts.

# Class C Airspace

Airspace surrounding airports of mid-sized cities with a large number of commercial flight operations; it extends from 700 feet Above Ground Level (AGL) to 4,000 AGL. An operating control tower at the primary airport and radar services are key components of Class C airspace.

# Class D Airspace

This airspace is applied to airports with operating control towers where the traffic volume does not meet Class C or Class B standards. This area encompasses 700 AGL to 2,500 AGL.

# Class E Airspace

This airspace class includes all airspace from 14,500 MSL up to, but not including 18,000 feet MSL. Class E airspace also includes all other controlled airspace necessary for IFR operations at lower altitudes but not already classified as A, B, C, or D. This includes features such as low level airways (victor airways) and IFR transition areas.

# Class G Airspace

Class G airspace is uncontrolled airspace and includes all airspace not otherwise designated as A, B, C, D, or E. Operations within Class G airspace are governed by the principle of "see and avoid."

#### A.2.2 En Route and Terminal Airways and Jet Routes

En route airspace in the United States consists of routing corridors used by both IFR and VFR traffic. Traffic is concentrated along these routes. Low altitude airways, termed victor airways, are the primary routes used by both IFR and VFR traffic. They are eight nautical miles wide and generally go from 1,200 feet above ground level up to, but not including, 18,000 MSL. The airway floor may be higher in areas of the western U.S. where terrain interferes more with the navigational facilities upon which the airways are based. They are depicted on aeronautical charts as blue shaded lines with a "V" (hence the term victor), followed by a number, such as V500, and are found on the sectionals, IFR en route low altitude charts, and terminal area charts.

Jet routes serve the same function as the low altitude airways except that they are found at 18,000 MSL and above (up to 45,000 MSL). Traffic on the jet routes is always IFR and is managed by air traffic control. Jet routes are shown on high altitude charts as a gray line and are designated by the letter "J," followed by a number, such as "J547."

#### A.2.3 Special Use Airspace

Special use airspace (SUA) is designed to segregate flight activity related to military and national security needs from other airspace users. Although most SUA involves military

activity, other areas involve civilian users such as the Department of Energy or the U.S. Secret Service.

Special Use Airspace is established by the FAA, usually at the request of the affected civilian agency or military branch. There are six different kinds of special use airspace: Prohibited Areas, Restricted Areas, Military Operations Areas, Alert Areas, Warning Areas, and Controlled Firing Areas.

#### Prohibited Areas

Prohibited areas are established over sensitive ground facilities such as the White House, presidential homes, and Camp David. All aircraft are prohibited from flight operations within a prohibited area unless specific prior approval is obtained from the FAA or the controlling agency.

#### Restricted Areas

Restricted areas are established in areas where ongoing or intermittent activities occur that create unusual hazards to aircraft, such as artillery firing, aerial firing, and missile testing. Restricted areas differ from prohibited areas in that most of them have specific hours of operation. Entry during those hours requires specific permission from the FAA or the controlling agency.

# Military Operations Areas

Military Operations Areas (MOA) are established to contain certain military activities, such as air combat maneuvers, intercepts, and acrobatics. Civilian flights are allowed within an MOA even when the area is in use by the military. Air traffic control will provide separation services to IFR traffic.

# Alert Areas

Alert Areas contain a high volume of pilot training or an unusual type of aerial activity, such as helicopter activity near oil rigs, which could present a hazard to other aircraft. There are no special requirements for operations within alert areas other than heightened vigilance.

#### Warning Areas

Warning areas contain the same kind of hazardous flight activity as restricted areas (artillery firing, aerial gunnery, etc.), but are located over domestic and international waters. Warning areas generally begin three miles offshore.

#### Controlled Firings Areas

Controlled firing areas contain civilian and military activities that could be hazardous to non-participating aircraft, such as rocket testing, ordinance disposal, and blasting. They are different from prohibited and restricted areas in that radar or a ground lookout is used to indicate when an aircraft is approaching the area, at which time all activities are suspended.

# A.3 Air Traffic Control Facilities and Equipment

Air traffic control specialists ensure that air traffic moves safely and efficiently through the NAS. That traffic includes not only commercial flights, but also military and general aviation flights.

Air traffic control is provided by three general classes of controllers, each resident in different types of facilities and responsible for a different phase of flight. First, ground and local controllers at Air Traffic Control Towers at airports handle aircraft from the gate to the taxiway and runway, through the take-off, and at the other end of the flight, from landing back to the gate. Second, radar controllers at the Terminal Radar Approach Control facilities handle aircraft from take-off to a cruising altitude at the origin (departure control) and return them through their approach at the destination (approach control). Third, en route controllers working at Air Route Traffic Control Centers manage the flow of traffic along the airways between the terminal areas.

The overall flow of aircraft across the entire United States is managed by the Air Traffic Control System Command Center in Herndon, Virginia. In addition, flight service stations provide important pre-flight and in-flight services to general aviation pilots. The functions of each of these air traffic control facilities are described briefly below.

#### A.3.1 Air Traffic Control Towers

Air Traffic Control Towers (ATCT) at more than 400 airports control the effective movement of traffic both on the ground and in the air within approximately five nautical miles of the airport and up to an altitude of 3,000 feet. Air traffic controllers rely on a combination of technology and visual surveillance to direct aircraft departures and approaches, maintain safe distances between aircraft, and communicate weather-related information, clearances, and other instructions to pilots.

#### A.3.2 Terminal Radar Approach Control Facilities

Over 185 Terminal Radar Approach Control (TRACON) facilities sequence and separate aircraft as they approach and depart major metropolitan areas. TRACONs typically control air traffic within a 30-mile radius and less than 15,000 feet altitude, exclusive of ATCT airspace. The FAA classifies TRACONS by the number of aircraft activities that they provide. An aircraft activity is any contact between a controller and an aircraft, so the number is substantially greater than the number of aircraft operations, which includes just, take offs and landings. Activities also include other measures.

The traffic within terminal airspace consists mostly of takeoffs and landings to and from the airports in its area, but also includes air traffic that is overflying the area. Terminal airspace is divided into sectors that can be modified, based on the runway configurations in use by the airports within that TRACON's airspace.

# A.3.3 Air Route Traffic Control Centers

Twenty-one Air Route Traffic Control Centers (ARTCCs) control and monitor aircraft in transit over the United States and during approaches to some airports. Each en route center handles a different region of airspace, passing control from one to another as respective borders are reached until the aircraft reaches TRACON airspace or leaves U.S. airspace.

Three centers—Oakland, New York and Anchorage—also control aircraft over the ocean. Outside radar range, which extends only 175 to 225 miles offshore, controllers must rely on periodic radio communication of position reports to determine an aircraft's location.

The centers are designated by a three-letter code that begins with Z; for example, the Cleveland center is designated ZOB. The size of the airspace managed by a center varies substantially, but typically consists of tens of thousands of square miles extending over several states.

# A.3.4 Air Traffic Control System Command Center

The Air Traffic Control System Command Center (ATCSCC) in Herndon, Virginia monitors traffic flows across the United States and communicates with other air traffic facilities and airline operating centers to minimize congestion and delays due to adverse weather, equipment outages, closed runways, and other capacity-related circumstances. The Command Center is one of the key parts of the FAA's evolving plan for management of an ever-increasing amount of air traffic.

# A.3.5 Flight Service Stations

The air traffic control specialists at flight service stations provide pre-flight and in-flight services to pilots, primarily those in general aviation. The specific services provided include flight plan filing; pre-flight and en route weather briefings that include the status of navigational aids; airport condition reports; search and rescue operations; assistance to lost or disoriented aircraft pilots; provision of instrumental flight rule and special visual flight rule clearances, soliciting pilot reports on flying conditions, and providing special services such as customs and immigration.

Pilots can receive these services by visiting a flight service station, by telephone, or through air-to-ground communications. The flight service stations also provide a weather briefing and flight plan processing service through the Direct User Access Terminal Service (DUATS), which can be accessed via toll-free telephone service.

#### A.4 Navigational Aids

An extensive network of facilities, generally known as navigational aids, or navaids, supports aircraft movement in the NAS. Pilots use en route navaids to guide aircraft from the vicinity of one airport to another. A typical en route navaid is the very high frequency omnidirectional range (VOR), which provides magnetic bearing information so that a pilot can determine the aircraft's position relative to the transmitter or its absolute position through triangulation with another en route navaid.

Other navaids help a pilot descend from cruising altitude to land on an airport runway. The instrument landing system (ILS), which consists of a localizer for horizontal guidance and a glide slope for vertical guidance, provides instrument approach capability to the runway during low visibility. The localizer is placed beyond the stop end of the runway, aligned with the centerline. The glide slope is located beside the runway, near the touchdown point. An ILS may be certified as Category (CAT) I, II, or III, depending on its equipment configuration and system capabilities.

Lighting systems, such as the precision approach path indicator (PAPI) and runway end identification lights (REIL), are navaids that provide pilots with visual cues to assist them in making safe approaches and landings.

The FAA plans to move from this system of ground-based navaids to a satellite-based system called the global positioning system (GPS). The basic GPS system is already being used by pilots for navigation in oceanic and en route airspace. Differential GPS will augment, and eventually replace, many of the ground-based navaids discussed above. The FAA anticipates that the wide area augmentation system (WAAS) will provide en route, terminal, non-precision approach and selected CAT I precision approach capability throughout the NAS. The GPS local area augmentation system (LAAS) will provide CAT II and III precision approach and landing capability.

APPENDIX B
AVIATION STATISTICS

#### **ERRATA**

The nation's busiest airports account for almost all passenger enplanements. Appendix B provides activity statistics for the top 100 of these airports. The rankings are based on calendar year 2000 enplanements. Aircraft operations are also provided for these same 100 airports. Please note that these are not generally the 100 airports with the most aircraft operations, although there is a fairly high correlation between enplanements and operations. The airport diagrams in Appendix D are for the same 100 airports, that is, those with the most calendar year 2000 enplanements.

Each year the airports that constitute the busiest 100 change slightly, as traffic at some airports grows more rapidly than at others. Often, several airports near the bottom of the list will be dropped off and replaced by others.

This year, the forecasts for both passenger enplanements and aircraft operations for the 40 busiest airports are preliminary. The FAA's Office of Aviation Policy & Plans is revising these estimates, but the final forecasts were not available at press time.

Airline traffic has been volatile during the past year, and is still reacting to the combination of a business recession and the terrorist attacks of September 11, 2001. Since the FAA issued its national level forecasts in March 2002, the underlying economic assumptions have changed and the anticipated recovery in the economy and the aviation industry has stalled. Major developments in the airline industry itself have increased the level of uncertainty for both the short- and long-term. These include the bankruptcy of U.S. Airways, the redeployment of flights at American Airlines hubs, and the serious financial difficulties at other carriers. For these reasons, APO is re-examining its forecasts at a number of the cities most directly affected by these developments.

Forecasting future aviation activity is always difficult and the further in the future these projections are made, the greater their uncertainty. However, at this time, the industry is facing an unprecedented level of volatility and rapid changes in fundamental industry patterns, making the accuracy of preliminary figures more uncertain than is usually the case. Therefore, please use these forecasts with the knowledge that they are preliminary and may be significantly adjusted, both up and down, and with greater volatility exhibited at individual airports than in the system as a whole. Revised numbers will be available early next year on the APO website.

 Table B-1
 Passenger Enplanements, by Fiscal and Calendar Years (1999, 2000, and 2001)

		Fiscal Year			Calendar Year			
Airport (ID)	Rank	1999	2000	2001	1999	2000	2001	
Hartsfield Atlanta International (ATL)	1	37,606,932	39,375,330	38,403,184	38,136,866	39,277,901	37,181,068	
Chicago O'Hare International (ORD)	2	34,418,016	34,153,190	32,861,464	34,050,083	33,845,895	31,529,561	
Los Angeles International (LAX)	3	30,436,893	32,332,452	31,501,162	30,830,915	32,167,896	29,365,436	
Dallas-Fort Worth International (DFW)	4	28,074,665	28,066,194	26,891,403	27,990,212	28,274,512	25,610,562	
Phoenix Sky Harbor International (PHX)	5	16,316,300	18,652,345	18,064,086	16,781,835	18,094,251	17,478,622	
Denver International (DEN)	6	18,148,611	18,883,765	18,068,664	18,039,836	18,382,940	17,178,872	
Las Vegas McCarran International (LAS)	7	15,630,979	17,530,409	17,215,302	16,055,319	17,425,214	16,633,435	
San Francisco International (SFO)	8	19,262,805	18,498,749	17,862,249	19,249,988	19,556,795	16,475,611	
George Bush Intercontinental/Houston (IAH)	9	14,996,958	16,564,385	16,576,594	15,267,294	16,358,035	16,173,551	
Minneapolis-St. Paul International (MSP)	10	15,422,494	17,203,373	16,462,360	15,683,399	16,959,014	15,852,433	
Detroit Metropolitan Wayne County (DTW)	11	16,910,175	17,873,801	16,698,964	16,982,496	17,326,775	15,819,584	
Newark Liberty International (EWR)	12	16,794,443	17,144,940	16,521,266	16,927,048	17,212,226	15,497,560	
Miami International (MIA)	13	16,561,634	16,716,291	15,740,006	16,531,295	16,489,341	14,941,663	
New York John F. Kennedy International (JFK)	14	15,244,975	16,080,974	15,734,725	15,375,183	16,155,437	14,553,815	
Orlando International (MCO)	15	13,780,567	15,136,268	14,483,116	14,026,868	14,831,648	13,622,397	
Lambert St. Louis International (STL)	16	14,831,699	14,552,733	14,139,923	15,075,992	15,288,493	13,264,751	
Seattle-Tacoma International (SEA)	17	13,377,182	14,225,451	13,604,468	13,610,469	13,875,942	13,184,630	
Boston Logan International (BOS)	18	13,090,336	13,816,195	12,831,269	13,183,145	13,613,507	11,739,553	
Philadelphia International (PHL)	19	11,711,796	13,022,732	12,175,642	11,762,140	12,294,051	11,736,129	
Charlotte-Douglas International (CLT)	20	10,754,284	11,936,722	11,859,005	10,618,589	11,469,282	11,548,952	
New York La Guardia (LGA)	21	11,769,143	12,567,451	12,342,023	11,968,030	12,697,208	11,352,248	
Baltimore-Washington International (BWI)	22	8,316,697	10,617,714	10,302,083	8,681,738	9,675,681	10,098,665	
Pittsburgh International (PIT)	23	9,480,757	10,520,627	10,183,267	9,302,650	9,871,995	9,939,223	
Honululu International (HNL)	24	10,611,794	10,511,446	10,150,357	10,974,390	11,174,701	9,810,860	
Salt Lake City International (SLC)	25	9,472,439	9,297,702	9,285,642	9,453,726	9,522,344	8,951,776	
Greater Cincinnati International (CVG)	26	10,801,642	9,185,962	8,951,201	10,863,290	11,223,966	8,586,907	
Washington Dulles International (IAD)	27	8,824,447	8,501,994	8,360,991	9,400,078	9,643,275	8,484,112	
Fort Lauderdale-Hollywood International (FLL)	28	6,858,842	8,541,532	8,147,642	6,932,142	7,817,173	8,015,055	
Tampa International (TPA)	29	7,348,044	8,200,264	8,102,506	7,490,117	7,969,797	7,901,725	
San Diego International Lindbergh Field (SAN)	30	7,550,495	7,953,273	7,780,769	7,636,623	7,898,360	7,506,320	
Chicago Midway (MDW)	31	5,973,886	7,214,205	7,236,415	6,218,667	7,059,520	7,112,784	
Ronald Reagan National (DCA)	32	7,277,596	7,959,838	7,374,029	7,166,772	7,517,811	6,267,395	
Portland International (PDX)	33	6,673,068	6,553,125	6,438,633	6,749,174	6,754,514	6,168,103	
Norman Y. Mineta San José International (SJC)	34	5,502,165	6,886,249	6,309,826	5,582,359	6,170,384	5,981,440	
Cleveland Hopkins International (CLE)	35	5,993,436	6,745,903	5,924,679	6,089,380	6,269,516	5,633,495	
Kansas City International (MCI)	36	5,728,867	5,888,791	5,879,219	5,760,037	5,903,296	5,614,347	
Metropolitan Oakland International (OAK)	37	4,733,764	5,821,456	5,623,479	4,850,517	5,196,451	5,566,100	
Memphis International (MEM)	38	5,069,903	6,234,454	5,876,534	5,211,305	5,684,619	5,560,524	
Raleigh-Durham International (RDU)	39	4,097,431	5,135,074	4,968,382	4,394,220	5,191,077	4,890,606	
Louis Armstrong New Orleans International (MSY)	40	4,669,177	4,900,382	4,947,243	4,735,571	4,936,271	4,767,533	
San Juan Luis Muñoz Marín International (SJU)	41	4,677,079	5,178,299	4,943,132	4,760,643	5,135,591	4,706,307	
Nashville International (BNA)	42	4,124,254	4,498,272	4,358,463	4,207,731	4,479,909	4,209,465	
Houston William B. Hobby (HOU)	43	4,222,752	4,239,410	4,265,788	4,243,907	4,354,609	4,128,980	

			Fiscal Year	Calendar Year			
Airport (ID)	Rank	1999	2000	2001	1999	2000	2001
Sacramento International (SMF)	44	3,739,973	3,977,530	4,097,754	3,783,566	3,979,043	4,021,102
John Wayne-Orange County (SNA)	45	3,708,121	3,803,407	3,787,262	3,739,968	3,914,051	3,688,304
Indianapolis International (IND)	46	3,729,011	3,848,584	3,750,829	3,736,811	3,833,975	3,595,425
Austin-Bergstrom International (AUS)	47	3,235,560	3,877,600	3,591,420	3,305,037	3,648,600	3,428,202
Bradley International (BDL)	48	2,990,923	3,630,661	3,571,026	3,148,196	3,651,943	3,416,243
Dallas-Love Field (DAL)	49	3,415,726	3,707,856	3,552,296	3,415,478	3,596,052	3,352,083
San Antonio International (SAT)	50	3,384,107	3,552,109	3,434,758	3,403,544	3,528,955	3,313,545
Port Columbus International (CMH)	51	3,309,279	3,499,475	3,402,615	3,366,430	3,441,286	3,296,013
Ontario International (ONT)	52	3,081,421	3,386,558	3,259,334	3,125,592	3,197,795	3,168,975
Albuquerque International (ABQ)	53	3,107,273	3,177,486	3,149,546	3,137,931	3,148,780	3,095,899
Palm Beach International (PBI)	54	2,822,271	2,895,252	2,979,195	2,877,039	2,928,658	2,954,015
Milwaukee General Mitchell International (MKE)	55	2,940,576	3,145,347	2,983,348	2,962,677	3,089,592	2,825,473
Kahului (OGG)	56	2,852,793	2,930,601	2,869,392	2,886,173	2,999,863	2,777,692
T.F. Green (PVD)	57	2,479,686	2,688,902	2,767,789	2,556,183	2,684,204	2,751,762
Fort Myers Southwest Florida Regional (RSW)	58	2,403,891	2,526,879	2,688,420	2,418,587	2,574,322	2,596,005
Jacksonville International (JAX)	59	2,408,602	2,615,286	2,610,899	2,445,231	2,616,211	2,523,809
Ted Stevens Anchorage International (ANC)	60	1,981,817	1,977,515	2,035,781	2,536,319	2,503,138	2,419,261
Reno Tahoe International (RNO)	61	2,936,412	2,824,584	2,498,416	2,912,801	2,732,837	2,388,923
Burbank-Glendale-Pasadena (BUR)	62	2,386,135	2,449,620	2,322,699	2,376,645	2,380,531	2,250,685
Greater Buffalo International (BUF)	63	1,775,824	2,517,454	2,325,775	1,827,466	2,140,002	2,204,087
Louisville International (SDF)	64	1,894,067	1,996,612	1,950,543	1,908,829	1,974,269	1,876,499
Omaha Eppley Airfield (OMA)	65	1,827,848	1,899,827	1,802,980	1,836,457	1,861,057	1,773,894
Tuscon International (TUS)	66	1,774,759	1,792,763	1,805,592	1,781,091	1,804,086	1,749,560
Oklahoma City Will Rogers World (OKC)	67	1,743,145	1,760,822	1,729,672	1,749,450	1,739,169	1,675,889
Tulsa International (TUL)	68	1,708,934	1,715,020	1,668,810	1,711,539	1,737,672	1,627,293
Manchester (MHT)	69	1,336,586	1,580,791	1,600,848	1,397,024	1,568,860	1,599,062
El Paso International (ELP)	70	1,663,004	1,685,686	1,616,621	1,688,927	1,678,287	1,544,734
Birmingham (BHM)	71	1,500,093	1,555,779	1,559,770	1,525,654	1,538,007	1,505,133
Guam (GUM)	72	1,507,821	1,648,783	1,657,127	1,550,245	1,665,676	1,489,164
Norfolk International (ORF)	73	1,488,519	1,531,236	1,485,273	1,494,396	1,518,552	1,478,687
Albany County (ALB)	74	1,139,963	1,343,034	1,512,482	1,140,518	1,407,092	1,463,632
Boise Air Terminal (BOI)	75	1,386,426	1,531,207	1,471,811	1,420,073	1,524,458	1,425,007
Spokane International (GEG)	76	1,494,400	1,560,577	1,468,964	1,516,688	1,534,342	1,423,624
Lihue (LIH)	77	1,306,051	1,385,839	1,335,368	1,345,733	1,413,454	1,342,287
Greensboro Piedmont Triad International (GSO)	78	1,370,143	1,395,692	1,402,775	1,382,198	1,402,168	1,317,519
Kona International (KOA)	79	1,265,532	1,347,671	1,286,032	1,271,744	1,352,606	1,235,893
Little Rock Adams Field (LIT)	80	1,285,014	1,296,442	1,253,209	1,292,507	1,276,145	1,211,753
Richmond International (RIC)	81	1,314,927	1,309,985	1,285,536	1,318,137	1,330,487	1,187,681
Greater Rochester International (ROC)	82	1,252,184	1,202,157	1,207,456	1,227,154	1,218,403	1,132,597
Dayton International (DAY)	83	1,109,094	1,166,726	1,128,856	1,115,756	1,164,032	1,070,456
Colorado Springs Municipal (COS)	84	1,247,484	1,209,120	1,110,323	1,223,324	1,205,552	1,050,344
Long Island MacArthur/Islip (ISP)	85	785,065	1,205,402	1,040,475	942,379	1,120,686	1,009,919
Syracuse Hancock International (SYR)	86	1,093,587	1,071,752	992,105	1,088,456	1,060,746	936,450

Enplanements Table B-1 continued

			Fiscal Year		Calendar Year		
Airport (ID)	Rank	1999	2000	2001	1999	2000	2001
Gerald R. Ford International (GRR)	87	905,280	950,164	943,620	907,773	960,640	906,768
Savannah International (SAV)	88	749,800	866,483	875,158	763,905	879,821	836,791
Des Moines International (DSM)	89	835,494	830,105	823,367	849,603	843,290	789,715
Charleston AFB International (CHS)	90	779,322	826,841	828,260	785,882	843,787	786,326
Hilo International (ITO)	91	722,555	748,066	718,594	735,668	791,398	714,537
Knoxville McGhee-Tyson (TYS)	92	862,187	885,008	75,667	878,737	863,539	705,607
Greer Greenville-Spartanburg (GSP)	93	742,634	792,339	750,723	753,892	788,807	701,606
Myrtle Beach International (MYR)	94	619,039	755,577	735,165	630,655	776,729	695,502
Madison/Dane County Regional (MSN)	95	680,480	668,869	693,911	681,272	673,451	675,034
Orlando-Sanford (SFB)	96	465,427	454,579	564,162	426,570	508,092	645,944
Jackson International (JAN)	97	659,502	686,124	671,471	670,251	679,103	642,146
Portland International Jetport (PWM)	98	681,163	665,566	665,166	678,852	668,098	625,591
Sarasota Bradenton (SRQ)	99	761,112	750,142	628,465	763,215	743,603	590,391
Palm Springs Regional (PSP)	100	630,835	662,378	625,411	645,926	648,648	586,028
Total Top 100		634,428,299	672,687,592	650,097,477	641,914,193	668,401,873	622,738,721

 Table B-2
 Aircraft Operations, by Fiscal and Calendar Years (1999, 2000, and 2001)

	Fiscal Year			Calendar Year		
Rank	1999	2000	2001	1999	2000	2001
1	898,855	906,326	927,896	897,290	908,977	911,861
2	895,435	922,016	898,899	909,911	913,449	887,403
3	867,146	875,673	835,748	867,338	865,777	802,587
4	771,337	781,418	783,160	779,150	783,684	738,679
5	555,793	624,261	627,561	563,843	638,757	606,666
6	561,295	561,123	540,966	559,548	554,580	523,039
7	494,884	520,882	526,204	500,612	528,604	507,826
8	505,064	524,261	512,102	510,420	522,253	501,252
9	523,424	535,935	513,679	542,922	521,300	498,970
10	503,538	489,529	486,503	501,239	484,224	478,947
11	460,158	483,806	489,987	463,173	490,568	477,367
12	505,483	510,113	499,474	502,164	508,283	471,989
13	445,485	458,697	471,731	444,629	460,370	471,155
14	523,277	516,009	489,058	516,507	516,545	469,871
15	478,397	484,963	475,577	480,279	483,567	467,183
16	439,032	449,168	452,696	438,412	448,181	451,180
17	463,492	458,677	462,202	463,000	457,182	445,082
18	459,098	495,717		482,787	479,931	424,150
19	430,572	444,630	423,903	433,660	445,677	400,670
20	372.057	368.713	393.027	363.224	371.784	397,557
21		478,558	403,399	524,205	449,050	395,653
22	371,447	381,746	398,451	374,817	386,335	393,925
23	436.659	437.763	407.040	440.032	430.554	387,599
						386,388
25	448,312	412,048	385,742	471,454	387,864	384,987
26			404.206		392.047	376,919
27						370,282
28						326,994
29						326,456
						323,771
						317,746
						300,166
						293,902
						291,714
						290,124
						276,520
						273,687
						272,299
						270,145
						261,800
						260,859
						247,173
43	251,199	259,861	257,295	252,763	259,860	245,439
	1 2 3 4 4 5 6 6 7 8 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	1       898,855         2       895,435         3       867,146         4       771,337         5       555,793         6       561,295         7       494,884         8       505,064         9       523,424         10       503,538         11       460,158         12       505,483         13       445,485         14       523,277         15       478,397         16       439,032         17       463,492         18       459,098         19       430,572         20       372,057         21       508,454         22       371,447         23       436,659         24       466,030         25       448,312         26       367,520         27       368,982         28       345,002         29       363,261         30       306,819         31       354,952         32       308,138         33       322,519         34       316,587	Rank         1999         2000           1         898,855         906,326           2         895,435         922,016           3         867,146         875,673           4         771,337         781,418           5         555,793         624,261           6         561,295         561,123           7         494,884         520,882           8         505,064         524,261           9         523,424         535,935           10         503,538         489,529           11         460,158         483,806           12         505,483         510,113           13         445,485         458,697           14         523,277         516,009           15         478,397         494,963           16         439,032         449,168           17         463,492         458,677           18         459,098         495,717           19         430,572         444,630           20         372,057         368,713           21         508,454         478,558           22         371,447         381,746	Rank         1999         2000         2001           1         898,855         906,326         927,896           2         895,435         922,016         898,899           3         867,146         875,673         835,748           4         771,337         781,418         783,160           5         555,793         624,261         627,561           6         561,295         561,123         540,966           7         494,884         520,882         526,204           8         505,064         524,261         512,102           9         523,424         535,935         513,679           10         503,538         489,529         486,503           11         460,158         483,806         489,987           12         505,483         510,113         499,474           13         445,485         458,697         471,731           14         523,277         516,009         489,058           15         478,397         484,963         475,577           16         439,032         449,168         452,696           17         463,492         458,677         462,202	Rank         1999         2000         2001         1999           1         898,855         906,326         927,896         897,290           2         895,435         922,016         898,899         909,911           3         867,146         675,673         835,748         867,338           4         771,337         781,418         783,160         779,150           5         555,793         624,261         627,561         563,843           6         561,295         561,123         540,966         559,548           7         494,884         520,882         526,204         500,612           8         505,064         524,261         512,102         510,420           9         523,424         535,935         513,679         542,922           10         503,538         489,529         486,503         501,239           11         460,158         483,806         489,987         463,173           12         505,483         510,113         499,474         502,164           13         445,485         458,697         471,731         404,629           14         523,277         516,009         489,058         5	Rank         1999         2000         2001         1999         2000           1         898.855         906.326         927.896         897.290         908.977           2         895.435         922.016         898.899         909.911         913.449           3         867.146         876.673         855.748         867.338         865.777           4         771.337         781.418         783.160         779.150         783.684           5         555.793         624.261         627,561         563.843         538.757           6         561.295         561.123         540,966         559.548         554.800           7         494.884         520.882         526,204         500,612         528.604           8         505,064         524,261         512,102         510,420         522,253           9         523,424         535,935         513,679         542,922         521,300           10         503,538         489,529         486,503         501,239         484,224           11         460,158         483,806         489,987         465,016         502,164         568,283           12         505,483         510,113

Operations Table B-2 continued

Airport (ID)	Fiscal Year				Calendar Year			
	Rank	1999	2000	2001	1999	2000	2001	
Dallas-Love Field (DAL)	44	243,140	259,106	249,823	248,281	256,787	243,849	
Port Columbus International (CMH)	45	228,974	235,538	243,203	223,435	238,011	243,201	
Albuquerque International (ABQ)	46	231,266	232,555	238,200	228,933	233,173	241,673	
Nashville International (BNA)	47	239,075	249,145	241,280	242,433	248,135	237,139	
San Antonio International (SAT)	48	251,038	255,622	234,423	256,148	246,200	236,102	
Long Island MacArthur/Islip (ISP)	49	207,707	229,617	232,430	204,380	238,239	226,591	
Austin-Bergstrom International (AUS)	50	185,421	203,863	224,575	186,819	212,635	220,439	
Palm Beach International (PBI)	51	196,866	209,241	223,406	198,468	214,327	212,640	
Milwaukee General Mitchell International (MKE)	52	219,104	225,426	214,549	221,866	221,855	211,512	
Kansas City International (MCI)	53	220,019	219,388	215,833	219,956	218,194	209,833	
San Diego International Lindbergh Field (SAN)	54	224,095	208,894	213,080	222,356	207,916	206,848	
Colorado Springs Municipal (COS)	55	223,223	230,677	199,364	237,770	220,739	206,221	
San Juan Luis Muñoz Marín International (SJU)	56	214,889	245,931	210,050	224,133	236,903	205,976	
Tulsa International (TUL)	57	199,402	204,940	195,669	201,907	198,970	199,533	
Oklahoma City Will Rogers World (OKC)	58	161,662	164,068	172,241	164,053	160,083	176,499	
Little Rock Adams Field (LIT)	59	179,336	180,547	173,476	181,958	174,802	176,067	
Louisville International (SDF)	60	174,250	180,819	177,642	175,282	181,535	175,852	
Sarasota Bradenton (SRQ)	61	194,151	174,782	167,596	192,088	169,537	170,842	
Greater Rochester International (ROC)	62	187,303	185,180	173,371	189,957	178,930	168,868	
Bradley International (BDL)	63	182.572	176.629	170.322	183.444	169.736	165,029	
Boise Air Terminal (BOI)	64	180,155	174,892	164,390	179,891	171,010	164,741	
Greater Buffalo International (BUF)	65	155,059	162,380	172,294	157,648	165,334	161,019	
Kahului (OGG)	66	192,479	176,156	165,832	188,387	174,855	160,324	
Burbank-Glendale-Pasadena (BUR)	67	178,916	162,867	159,832	175,278	160,730	159,705	
Louis Armstrong New Orleans International (MSY)	68	168,891	167,016	162,507	166,972	167,502	157,326	
Ontario International (ONT)	69	157,481	153.396	157.448	156.607	155.026	154.900	
Sacramento International (SMF)	70	154,165	152,205	151,613	155,521	149,969	151,642	
Knoxville McGhee-Tyson (TYS)	71	142,354	151,965	147,689	148,384	148,596	149,342	
Birmingham (BHM)	72	156.513	154.143	149.996	155.842	153.917	148.869	
T.F. Green (PVD)	73	157,597	157,228	148,800	156,366	155,545	148,336	
Albany County (ALB)	74	149,782	145,889	148,233	148,946	144,761	148,331	
Syracuse Hancock International (SYR)	75	152,186	141.793	146,047	151.154	140,291	145.751	
Richmond International (RIC)	76	128,892	143,341	148,993	127,986	149,918	144,902	
Omaha Eppley Airfield (OMA)	77	184,933	178,173	147,163	188,216	167,879	143,973	
Reno Tahoe International (RNO)	78	152,633	151.589	142,119	152,103	149.873	139,663	
Jacksonville International (JAX)	79	162,628	149,705	142,561	161,539	148,797	134,572	
Greensboro Piedmont Triad International (GSO)	80	132,289	137,526	138,607	133,398	138,641	133,550	
Dayton International (DAY)	81	152,004	148.085	135,992	151,116	145.123	131.651	
Madison/Dane County Regional (MSN)	82	144,736	134,703	124,429	145,716	125,755	128,555	
El Paso International (ELP)	83	144,761	141,768	129,438	145,040	140,618	126,545	
Gerald R. Ford International (GRR)	84	138,383	140.394	127,903	138,332	136,465	126.224	
Charleston AFB International (CHS)	85	129,140	140,021	131,638	137,487	136,129	125,499	
Norfolk International (ORF)	86	151,120	133,482	120,438	140,920	133,856	119,320	

Operations Table B-2 continued

		Fiscal Year			Calendar Year		
Airport (ID)	Rank	1999	2000	2001	1999	2000	2001
Des Moines International (DSM)	87	136,054	129,896	121,469	134,765	127,668	118,068
Portland International Jetport (PWM)	88	128,964	109,179	111,968	125,026	106,252	112,043
Spokane International (GEG)	89	114,793	119,210	111,739	115,947	117,759	110,314
Savannah International (SAV)	90	108,831	112,449	110,104	110,794	112,614	109,047
Kona International (KOA)	91	82,752	91,306	105,510	82,886	97,974	107,813
Manchester (MHT)	92	118,028	107,545	109,232	113,687	106,086	106,633
Lihue (LIH)	93	115,344	112,198	108,013	218,088	113,842	103,654
Palm Springs Regional (PSP)	94	102,030	101,147	97,620	103,857	96,059	98,558
Hilo International (ITO)	95	115,009	116,375	103,169	115,916	115,536	96,238
Jackson International (JAN)	96	111,546	97,610	92,324	108,034	90,753	92,463
Fort Myers Southwest Florida Regional (RSW)	97	74,174	76,497	77,616	74,502	77,376	75,779
Greer Greenville-Spartanburg (GSP)	98	62,577	68,541	70,092	63,433	70,378	68,201
Myrtle Beach International (MYR)	99	70,383	77,775	67,119	73,476	73,646	65,554
Guam (GUM)	100	57,351	60,149	65,467	121,542	63,389	58,405
Total Top 100		28,112,482	28,441,792	27,745,292	28,470,647	28,254,954	26,970,206

 Table B-3
 Passenger Enplanements, 2001 and Forecast 2013

# Changes in Enplanements (Fiscal Year)

			Changes in Enplanements (Fiscal Year)			
Airport (ID)	Rank	2001	2013	Change from 2001		
Orlando-Sanford (SFB)	1	564,162	1,195,286	111.9%		
Greater Cincinnati International (CVG)	2	8,951,201	17,961,187	100.7%		
Boise Air Terminal (BOI)	3	1,471,811	2,871,744	95.1%		
Metropolitan Oakland International (OAK)	4	5,623,479	10,638,795	89.2%		
Chicago Midway (MDW)	5	7,236,415	12,893,737	78.2%		
Fort Lauderdale-Hollywood International (FLL)	6	8,147,642	13,894,421	70.5%		
Norfolk International (ORF)	7	1,485,273	2,447,477	64.8%		
Manchester (MHT)	8	1,600,848	2,596,088	62.2%		
Omaha Eppley Airfield (OMA)	9	1,802,980	2,908,531	61.3%		
Philadelphia International (PHL)	10	12,175,642	19,324,306	58.7%		
Minneapolis-St. Paul International (MSP)	11	16,462,360	25,916,165	57.4%		
Knoxville McGhee-Tyson (TYS)	12	756,667	1,190,064	57.3%		
Tampa International (TPA)	13	8,102,506	12,701,159	56.8%		
Washington Dulles International (IAD)	14	8,360,991	13,044,126	56.0%		
Gerald R. Ford International (GRR)	15	943,620	1,455,273	54.2%		
Louisville International (SDF)	16	1,950,543	2,965,958	52.1%		
Long Island MacArthur/Islip (ISP)	17	1,040,475	1,580,591	51.9%		
T.F.Green (PVD)	18	2,767,789	4,188,020	51.3%		
Bradley International (BDL)	19	3,571,026	5,357,299	50.0%		
Milwaukee General Mitchell International (MKE)	20	2,983,348	4,461,390	49.5%		
Ontario International (ONT)	21	3,259,334	4,855,608	49.0%		
Austin-Bergstrom International (AUS)	22	3,591,420	5,305,919	47.7%		
Colorado Springs Municipal (COS)	23	1,110,323	1,639,084	47.6%		
Tuscon International (TUS)	24	1,805,592	2,652,746	46.9%		
George Bush Intercontinental/Houston (IAH)	25	16,576,594	24,182,179	45.9%		
Albuquerque International (ABQ)	26	3,149,546	4,593,932	45.9%		
Myrtle Beach International (MYR)	27	735,165	1,069,106	45.4%		
Birmingham (BHM)	28	1,559,770	2,262,292	45.0%		
Madison-Dane County Regional (MSN)	29	693,911	1,006,376	45.0%		
Hartsfield Atlanta International (ATL)	30	38,403,184	55,678,527	45.0%		
Denver International (DEN)	31	18,068,664	26,145,884	44.7%		
Newark Liberty International (EWR)	32	16,521,266	23,858,158	44.4%		
Jacksonville International (JAX)	33	2,610,899	3,768,456	44.3%		
Port Columbus International (CMH)	34	3,402,615	4,885,352	43.6%		
Spokane International (GEG)	35	1,468,964	2,106,478	43.4%		
Phoenix Sky Harbor International (PHX)	36	18,064,086	25,850,073	43.1%		
John Wayne-Orange County (SNA)	37	3,787,262	5,413,443	42.9%		
Guam International (GUM)	38	1,657,127	2,364,774	42.7%		
Dallas-Fort Worth International (DFW)	39	26,891,403	38,187,824	42.0%		
Cleveland Hopkins International (CLE)	40	5,924,679	8,385,550	41.5%		
Raleigh-Durham International (RDU)	41	4,968,382	7,027,625	41.4%		
Fort Myers Southwest Florida Regional (RSW)	42	2,688,420	3,802,283	41.4%		
Baltimore-Washington International (BWI)	43	10,302,083	14,562,279	41.4%		

# Changes in Enplanements (Fiscal Year)

			changes in Enplanements (Fiscal Year)			
Airport (ID)	Rank	2001	2013	Change from 2001		
Detroit Metropolitan Wayne County (DTW)	44	16,698,964	23,564,304	41.1%		
Savannah International (SAV)	45	875,158	1,234,602	41.1%		
Sacramento International (SMF)	46	4,097,754	5,771,109	40.8%		
Jackson International (JAN)	47	671,471	938,534	39.8%		
San Antonio International (SAT)	48	3,434,758	4,797,806	39.7%		
Fed Stevens Anchorage International (ANC)	49	2,035,781	2,836,746	39.3%		
Oklahoma City Will Rogers World (OKC)	50	1,729,672	2,403,179	38.9%		
Norman Y. Mineta San José International (SJC)	51	6,309,826	8,737,417	38.5%		
Nashville International (BNA)	52	4,358,463	6,021,541	38.2%		
Greensboro Piedmont Triad International (GSO)	53	1,402,775	1,935,181	38.0%		
Orlando International (MCO)	54	14,483,116	19,871,264	37.2%		
as Vegas McCarran International (LAS)	55	17,215,302	23,598,204	37.1%		
Chicago O'Hare International (ORD)	56	32,861,464	45,014,919	37.0%		
ndianapolis International (IND)	57	3,750,829	5,134,954	36.9%		
Miami International (MIA)	58	15,740,006	21,544,409	36.9%		
Kansas City International (MCI)	59	5,879,219	7,837,566	33.3%		
San Diego International Lindbergh Field (SAN)	60	7,780,769	10,368,370	33.3%		
El Paso International (ELP)	61	1,616,621	2,135,657	32.1%		
Charleston AFB International (CHS)	62	828,260	1,091,466	31.8%		
ouis Armstrong New Orleans International (MSY)	63	4,947,243	6,517,399	31.7%		
Memphis International (MEM)	64	5,876,534	7,739,709	31.7%		
Portland International (PDX)	65	6,438,633	8,477,233	31.7%		
os Angeles International (LAX)	66	31,501,162	41,377,848	31.4%		
San Juan Luis Muñoz Marín International (SJU)	67	4,943,132	6,491,420	31.3%		
lilo International (ITO)	68	718,594	943,426	31.3%		
Burbank-Glendale-Pasadena (BUR)	69	2,322,699	3,035,859	30.7%		
Portland International Jetport (PWM)	70	665,166	864,951	30.0%		
San Francisco International (SFO)	71	17,862,249	23,161,655	29.7%		
Salt Lake City International (SLC)	72	9,285,642	12,024,921	29.5%		
Seattle-Tacoma International (SEA)	73	13,604,468	17,565,442	29.1%		
Honolulu International (HNL)	74	10,150,357	13,096,525	29.0%		
Kahului (OGG)	75	2,869,392	3,698,644	28.9%		
Charlotte-Douglas International (CLT)	76	11,859,005	15,279,470	28.8%		
Boston Logan International (BOS)	77	12,831,269	16,505,808	28.6%		
Richmond International (RIC)	78	1,285,536	1,653,051	28.6%		
Greater Buffalo International (BUF)	79	2,325,775	2,978,858	28.1%		
lew York John F. Kennedy International (JFK)	80	15,734,725	20,068,352	27.5%		
ittsburgh International (PIT)	81	10,183,267	12,965,863	27.3%		
ittle Rock Adams Field (LIT)	82	1,253,209	1,572,789	25.5%		
Greer Greenville-Spartanburg (GSP)	83	750,723	939,815	25.2%		
Palm Beach International (PBI)	84	2,979,195	3,710,326	24.5%		
Reno Tahoe International (RNO)	85	2,498,416	3,050,068	22.1%		
Syracuse Hancock International (SYR)	86	992,105	1,205,206	21.5%		

Table B-3 continued

# Changes in Enplanements (Fiscal Year)

Airport (ID)	Rank	2001	2013	Change from 2001
Kona International (KOA)	87	1,286,032	1,562,235	21.5%
Palm Springs Regional (PSP)	88	625,411	752,484	20.3%
Albany County (ALB)	89	1,512,482	1,795,193	18.7%
Des Moines International (DSM)	90	823,367	969,059	17.7%
Lambert St. Louis International (STL)	91	14,139,923	16,530,574	16.9%
New York La Guardia (LGA)	92	12,342,023	14,338,063	16.2%
Houston William B. Hobby (HOU)	93	4,265,788	4,675,308	9.6%
Dayton International (DAY)	94	1,128,856	1,236,358	9.5%
Ronald Reagan National (DCA)	95	7,374,029	7,997,355	8.5%
Tulsa International (TUL)	96	1,668,810	1,797,802	7.7%
Greater Rochester International (ROC)	97	1,207,456	1,298,671	7.6%
Lihue (LIH)	98	1,335,368	1,435,902	7.5%
Sarasota Bradenton (SRQ)	99	628,465	643,625	2.4%
Dallas-Love Field (DAL)	100	3,552,296	3,538,092	-0.4%
Total Top 100		650,778,477	907,528,152	39.5%

Data Source: APO-130

Table B-4 Aircraft Operations, 2001 and Forecast 2013

# Changes in Operations (Fiscal Year)

			Changes in Operations (Fiscal Year)						
Airport (ID)	Rank	2001	2013	Change from 2001					
Greater Cincinnati International (CVG)	1	390,306	692,569	77.4%					
Chicago Midway (MDW)	2	280,527	437,739	56.0%					
Minneapolis-St. Paul International (MSP)	3	512,102	773,721	51.1%					
San Antonio International (SAT)	4	234,423	349,854	49.2%					
Kona International (KOA)	5	105,510	157,284	49.1%					
Colorado Springs Municipal (COS)	6	199,364	291,046	46.0%					
Denver International (DEN)	7	526,204	761,121	44.6%					
Hartsfield Atlanta International (ATL)	8	898,899	1,244,420	38.4%					
Detroit Metropolitan Wayne County (DTW)	9	540,966	746,500	38.0%					
Salt Lake City International (SLC)	10	363,682	494,537	36.0%					
Metropolitan Oakland International (OAK)	11	403,399	544,606	35.0%					
Ted Stevens Anchorage International (ANC)	12	304,988	409,252	34.2%					
Kahului (OGG)	13	165,832	222,142	34.0%					
Albuquerque International (ABQ)	14	238,200	318,604	33.8%					
Sacramento International (SMF)	15	151,613	200,385	32.2%					
Savannah International (SAV)	16	110,104	144,680	31.4%					
Sarasota Bradenton (SRQ)	17	167,596	220,186	31.4%					
Oklahoma City Will Rogers World (OKC)	18	172,241	226,261	31.4%					
Memphis International (MEM)	19	398,451	520,699	30.7%					
Orlando International (MCO)	20	342,315	446,888	30.5%					
Dallas-Fort Worth International (DFW)	21	835,748	1,088,794	30.3%					
Newark Liberty International (EWR)	22	462,202	601,967	30.2%					
Philadelphia International (PHL)	23	475,577	617,935	29.9%					
Louisville International-Standiford Field (SDF)	24	177,643	229,222	29.0%					
Ontario International (ONT)	25	157,448	202,922	28.9%					
Madison/Dane County Regional (MSN)	26	124,429	159,715	28.4%					
Omaha Eppley Airfield (OMA)	27	147,163	188,375	28.0%					
George Bush Intercontinental/Houston (IAH)	28	489,987	625,895	27.7%					
Boise Air Terminal (BOI)	29	164,390	207,315	26.1%					
Milwaukee General Mitchell International (MKE)	30	214,549	269,047	25.4%					
Fort Myers Southwest Florida Regional (RSW)	31	77,616	97,041	25.0%					
Port Columbus International (CMH)	32	243,203	303,642	24.9%					
Austin-Bergstrom International (AUS)	33	224,575	277,105	23.4%					
Fort Lauderdale-Hollywood International (FLL)	34	299,773	368,244	22.8%					
John Wayne-Orange County (SNA)	35	385,742	472,727	22.6%					
Nashville International (BNA)	36	241,280	295,559	22.5%					
T.F.Green (PVD)	37	148,800	182,190	22.4%					
Myrtle Beach International (MYR)	38	67,119	81,844	21.9%					
Norfolk International (ORF)	39	120,438	146,206	21.4%					
Albany County (ALB)	40	148,233	178,887	20.7%					
Chicago O'Hare International (ORD)	41	927,896	1,119,581	20.7%					
Baltimore-Washington International (BWI)	42	328,428	395,403	20.4%					
Phoenix Sky Harbor International (PHX)	43	627,561	755,376	20.4%					

Table B-4 continued

# Changes in Operations (Fiscal Year)

			changes in Operations (Fiscal Year)					
Airport (ID)	Rank	2001	2013	Change from 2001				
Greater Pittsburgh International (PIT)	44	452,696	544,641	20.3%				
Portland International Jetport (PWM)	45	111,968	134,532	20.2%				
Louis Armstrong New Orleans International (MSY)	46	162,507	194,810	19.9%				
Gerald R. Ford International (GRR)	47	127,903	153,002	19.6%				
Bradley International (BDL)	48	170,322	203,473	19.5%				
San Diego International Lindbergh Field (SAN)	49	213,080	254,332	19.4%				
Washington Dulles International (IAD)	50	430,082	512,005	19.0%				
Greensboro Piedmont Triad International (GSO)	51	138,607	164,632	18.8%				
Las Vegas McCarran International (LAS)	52	513,679	608,348	18.4%				
Kansas City International (MCI)	53	215,833	255,563	18.4%				
Tuscon International (TUS)	54	258,031	303,037	17.4%				
Honululu International (HNL)	55	339,987	397,410	16.9%				
Tulsa International (TUL)	56	195,669	227,692	16.4%				
Portland International (PDX)	57	304,896	354,101	16.1%				
El Paso International (ELP)	58	129,438	150,215	16.1%				
Long Island MacArthur/Islip (ISP)	59	232,430	267,600	15.1%				
Charlotte-Douglas International (CLT)	60	471,731	542,695	15.0%				
Lihue (LIH)	61	108,013	124,223	15.0%				
Indianapolis International (IND)	62	257,295	294,847	14.6%				
Tampa International (TPA)	63	269,948	309,293	14.6%				
San Juan Luis Muñoz Marín International (SJU)	64	210,050	238,604	13.6%				
Jacksonville International (JAX)	65	142,561	161,767	13.5%				
Knoxville McGhee-Tyson (TYS)	66	147,689	166,839	13.0%				
Miami International (MIA)	67	489,058	549,703	12.4%				
Little Rock Adams Field (LIT)	68	173,476	194,484	12.1%				
Cleveland Hopkins International (CLE)	69	305,299	342,014	12.0%				
Burbank-Glendale-Pasadena (BUR)	70	159,832	178,852	11.9%				
Orlando-Sanford (SFB)	71	393,027	438,881	11.7%				
Raleigh-Durham International (RDU)	72	293,995	325,043	10.6%				
Palm Springs Regional (PSP)	73	97,620	107,879	10.5%				
Birmingham (BHM)	74	149,996	165,603	10.4%				
Los Angeles International (LAX)	75	783,160	864,431	10.4%				
New York John F. Kennedy International (JFK)	76	340,459	375,143	10.2%				
Seattle-Tacoma International (SEA)	77	423,903	465,431	9.8%				
Spokane International (GEG)	78	111,739	121,877	9.1%				
Reno Tahoe International (RNO)	79	142,119	154,188	8.5%				
Norman Y. Mineta San José International (SJC)	80	285,507	307,581	7.7%				
San Francisco International (SFO)	81	407,040	435,633	7.0%				
Lambert St. Louis International (STL)	82	486,503	520,661	7.0%				
Greer Greenville-Spartanburg (GSP)	83	70,092	74,623	6.5%				
Richmond International (RIC)	84	148,993	158,416	6.3%				
Jackson International (JAN)	85	92,324	97,778	5.9%				
Boston Logan International (BOS)	86	499,474	528,559	5.8%				

Table B-4 continued

# Changes in Operations (Fiscal Year)

Airport (ID)	Rank	2001	2013	Change from 2001
Charleston AFB International (CHS)	87	131,638	137,626	4.5%
Manchester (MHT)	88	109,232	113,510	3.9%
Dallas-Love Field (DAL)	89	249,823	258,198	3.4%
New York La Guardia (LGA)	90	404,206	417,530	3.3%
Hilo International (ITO)	91	103,169	106,510	3.2%
Greater Rochester International (ROC)	92	173,371	178,518	3.0%
Dayton International (DAY)	93	135,992	137,956	1.4%
Des Moines International (DSM)	94	121,469	122,390	0.8%
Greater Buffalo International (BUF)	95	172,294	169,288	-1.7%
Guam (GUM)	96	65,467	64,296	-1.8%
Syracuse Hancock International (SYR)	97	146,047	143,272	-1.9%
Palm Beach International (PBI)	98	223,406	210,509	-5.8%
Houston William B. Hobby (HOU)	99	248,111	232,902	-6.1%
Ronald Reagan National (DCA)	100	328,340	263,091	-19.9%
Total Top 100		27,667,118	33,593,523	21.4%

Source: APO-130

Table B-5 Change in Enplanements from 2000 to 2001

# Changes in Enplanements (Fiscal Year)

		<u> </u>	Changes in Enplanements (Fiscal Year)				
Airport (ID)	Rank	2000	2001	Change from 2000			
Orlando-Sanford (SFB)	1	454,579	564,162	24.1%			
Albany County (ALB)	2	1,343,034	1,512,482	12.6%			
Fort Myers Southwest Florida Regional (RSW)	3	2,526,879	2,688,420	6.4%			
New York La Guardia (LGA)	4	12,567,451	13,242,023	5.4%			
Madison-Dane County Regional (MSN)	5	668,869	693,911	3.7%			
Sacramento International (SMF)	6	3,977,530	4,097,754	3.0%			
Fed Stevens Anchorage International (ANC)	7	1,977,515	2,035,781	2.9%			
F. Green (PVD)	8	2,688,902	2,767,789	2.9%			
Palm Beach International (PBI)	9	2,895,252	2,979,195	2.9%			
Manchester (MHT)	10	1,580,791	1,600,848	1.3%			
Savannah International (SAV)	11	866,483	875,158	1.0%			
ouis Armstrong New Orleans International (MSY)	12	4,900,382	4,947,243	1.0%			
Tuscon International (TUS)	13	1,792,763	1,805,592	0.7%			
Houston William B. Hobby (HOU)	14	4,239,410	4,265,788	0.6%			
Greensboro Piedmont Triad International (GSO)	15	1,395,692	1,402,775	0.5%			
Guam (GUM)	16	1,648,783	1,657,127	0.5%			
Greater Rochester International (ROC)	17	1,202,157	1,207,456	0.4%			
chicago Midway (MDW)	18	7,214,205	7,236,415	0.3%			
irmingham (BHM)	19	1,555,779	1,559,770	0.3%			
harleston AFB International (CHS)	20	826,841	828,260	0.2%			
eorge Bush Intercontinental/Houston (IAH)	21	16,564,385	16,576,594	0.1%			
ortland International Jetport (PWM)	22	665,566	665,166	-0.1%			
alt Lake City International (SLC)	23	9,297,702	9,285,642	-0.1%			
ansas City International (MCI)	24	5,888,791	5,879,219	-0.2%			
acksonville International (JAX)	25	2,615,286	2,610,899	-0.2%			
ohn Wayne-Orange County (SNA)	26	3,803,407	3,787,262	-0.4%			
Charlotte-Douglas International (CLT)	27	11,936,722	11,859,005	-0.7%			
Gerald R. Ford International (GRR)	28	950,164	943,620	-0.7%			
Des Moines International (DSM)	29	830,105	823,367	-0.8%			
lbuquerque International (ABQ)	30	3,177,486	3,149,546	-0.9%			
ampa International (TPA)	31	8,200,264	8,102,506	-1.2%			
radley International (BDL)	32	3,630,661	3,571,026	-1.6%			
Vashington Dulles International (IAD)	33	8,501,994	8,360,991	-1.7%			
ortland International (PDX)	34	6,553,125	6,438,633	-1.7%			
Oklahoma City Will Rogers World (OKC)	35	1,760,822	1,729,672	-1.8%			
as Vegas McCarran International (LAS)	36	17,530,409	17,215,302	-1.8%			
ichmond International (RIC)	37	1,309,985	1,285,536	-1.9%			
ahului (OGG)	38	2,930,601	2,869,392	-2.1%			
ackson International (JAN)	39	686,124	671,471	-2.1%			
lew York John F. Kennedy International (JFK)	40	16,080,974	15,734,725	-2.2%			
Can Diego International Lindbergh Field (SAN)	41	7,953,273	7,780,769	-2.2%			
ouisville International (SDF)	42	1,996,612	1,950,543	-2.3%			
Hartsfield Atlanta International (ATL)	43	39,375,330	38,403,184	-2.5%			

# Changes in Enplanements (Fiscal Year)

			Changes in Enplanements (Fiscal Year)				
Airport (ID)	Rank	2000	2001	Change from 2000			
ndianapolis International (IND)	44	3,848,584	3,750,829	-2.5%			
Greater Cincinnati International (CVG)	45	9,185,962	8,951,201	-2.6%			
os Angeles International (LAX)	46	32,332,452	31,501,162	-2.6%			
「ulsa International (TUL)	47	1,715,020	1,668,810	-2.7%			
Myrtle Beach International (MYR)	48	755,577	735,165	-2.7%			
Port Columbus International (CMH)	49	3,499,475	3,402,615	-2.8%			
ambert St. Louis International (STL)	50	14,552,733	14,139,923	-2.8%			
Baltimore-Washington International (BWI)	51	10,617,714	10,302,083	-3.0%			
Norfolk International (ORF)	52	1,531,236	1,485,273	-3.0%			
Nashville International (BNA)	53	4,498,272	4,358,463	-3.1%			
Phoenix Sky Harbor International (PHX)	54	18,652,345	18,064,086	-3.2%			
Pittsburgh International (PIT)	55	10,520,627	10,183,267	-3.2%			
Dayton International (DAY)	56	1,166,726	1,128,856	-3.2%			
Raleigh-Durham International (RDU)	57	5,135,074	4,968,382	-3.2%			
San Antonio International (SAT)	58	3,552,109	3,434,758	-3.3%			
Little Rock Adams Field (LIT)	59	1,296,442	1,253,209	-3.3%			
Metropolitan Oakland International (OAK)	60	5,821,456	5,623,479	-3.4%			
Honolulu International (HNL)	61	10,511,446	10,150,357	-3.4%			
an Francisco International (SFO)	62	18,498,749	17,862,249	-3.4%			
Jewark Liberty International (EWR)	63	17,144,940	16,521,266	-3.6%			
ihue (LIH)	64	1,385,839	1,335,368	-3.6%			
Ontario International (ONT)	65	3,386,558	3,259,334	-3.8%			
Chicago O'Hare International (ORD)	66	34,153,190	32,861,464	-3.8%			
Boise Air Terminal (BOI)	67	1,531,207	1,471,811	-3.9%			
lilo International (ITO)	68	748,066	718,594	-3.9%			
I Paso International (ELP)	69	1,685,686	1,616,621	-4.1%			
Dallas-Fort Worth International (DFW)	70	28,066,194	26,891,403	-4.2%			
Pallas-Love Field (DAL)	71	3,707,856	3,552,296	-4.2%			
Minneapolis-St. Paul International (MSP)	72	17,203,373	16,462,360	-4.3%			
Orlando International (MCO)	73	15,136,268	14,483,116	-4.3%			
Denver International (DEN)	74	18,883,765	18,068,664	-4.3%			
Seattle-Tacoma International (SEA)	75	14,225,451	13,604,468	-4.4%			
San Juan Luis Muñoz Marín International (SJU)	76	5,178,299	4,943,132	-4.5%			
ona International (KOA)	77	1,347,671	1,286,032	-4.6%			
ort Lauderdale-Hollywood International (FLL)	78	8,541,532	8,147,642	-4.6%			
Omaha Eppley Airfield (OMA)	79	1,899,827	1,802,980	-5.1%			
Milwaukee General Mitchell International (MKE)	80	3,145,347	2,983,348	-5.2%			
Burbank-Glendale-Pasadena (BUR)	81	2,449,620	2,322,699	-5.2%			
Greer Greenville-Spartanburg (GSP)			-5.3%				
Palm Springs Regional (PSP)	83	662,378	625,411	-5.6%			
Memphis International (MEM)	84	6,234,454	5,876,534	-5.7%			
Miami International (MIA)	85	16,716,291	15,740,006	-5.8%			
Spokane International (GEG)	86	1,560,577	1,468,964	-5.9%			

Table B-5 continued

# Changes in Enplanements (Fiscal Year)

Airport (ID)	Rank	2000	2001	Change from 2000
Philadelphia International (PHL)	87	13,022,732	12,175,642	-6.5%
Detroit Metropolitan Wayne County (DTW)	88	17,873,801	16,698,964	-6.6%
Boston Logan International (BOS)	89	13,816,195	12,831,269	-7.1%
Ronald Reagan National (DCA)	90	7,959,838	7,374,029	-7.4%
Austin-Bergstrom International (AUS)	91	3,877,600	3,591,420	-7.4%
Syracuse Hancock International (SYR)	92	1,071,752	992,105	-7.4%
Greater Buffalo International (BUF)	93	2,517,454	2,325,775	-7.6%
Colorado Springs Municipal (COS)	94	1,209,120	1,110,323	-8.2%
Norman Y. Mineta San José International (SJC)	95	6,886,249	6,309,826	-8.4%
Reno Tahoe International (RNO)	96	2,824,584	2,498,416	-11.5%
Cleveland Hopkins International (CLE)	97	6,745,903	5,924,679	-12.2%
Long Island MacArthur/Islip (ISP)	98	1,205,402	1,040,475	-13.7%
Knoxville McGhee-Tyson (TYS)	99	885,008	756,667	-14.5%
Sarasota Bradenton (SRQ)	100	750,142	628,465	-16.2%
Total Top 100		672,687,592	651,678,477	-3.1%

Data Source: APO

Table B-6 Change in Operations from 2000 to 2001

# Changes in Operations (Fiscal Year)

		'	Changes in Operations (Fiscal Year)					
Airport (ID)	Rank	2000	2001	Change from 2000				
Kona International (KOA)	1	91,306	105,510	15.6%				
Austin-Bergstrom International (AUS)	2	203,863	224,575	10.2%				
Guam (GUM)	3	60,149	65,467	8.8%				
New York La Guardia (LGA)	4	378,018	404,206	6.9%				
Palm Beach International (PBI)	5	209,241	223,406	6.8%				
Orlando-Sanford (SFB)	6	368,718	393,027	6.6%				
Baltimore-Washington International (BWI)	7	309,516	328,428	6.1%				
Greater Buffalo International (BUF)	8	162,380	172,294	6.1%				
Oklahoma City Will Rogers World (OKC)	9	164,068	172,241	5.0%				
ort Lauderdale-Hollywood International (FLL)	10	287,094	299,773	4.4%				
Memphis International (MEM)	11	381,746	398,451	4.4%				
Richmond International (RIC)	12	143,341	148,993	3.9%				
Port Columbus International (CMH)	13	235,538	243,203	3.3%				
Syracuse Hancock International (SYR)	14	141,793	146,047	3.0%				
Charlotte-Douglas International (CLT)	15	458,697	471,731	2.8%				
Ontario International (ONT)	16	153,396	157,448	2.6%				
Portland International Jetport (PWM)	17	109,179	111,968	2.6%				
ulbuquerque International (ABQ)	18	232,555	238,200	2.4%				
hicago O'Hare International (ORD)	19	906,326	927,896	2.4%				
reer Greenville-Spartanburg (GSP)	20	68,541	70,092	2.3%				
an Diego International Lindbergh Field (SAN)	21	208,894	213,080	2.0%				
lbany County (ALB)	22	145,889	148,233	1.6%				
Manchester (MHT)	23	107,545	109,232	1.6%				
ort Myers Southwest Florida Regional (RSW)	24	76,497	77,616	1.5%				
eorge Bush Intercontinental/Houston (IAH)	25	483,806	489,987	1.3%				
ong Island MacArthur/Islip (ISP)	26	229,617	232,430	1.2%				
Denver International (DEN)	27	520,882	526,204	1.0%				
Greensboro Piedmont Triad International (GSO)	28	137,526	138,607	0.8%				
Greater Pittsburgh International (PIT)	29	449,168	452,696	0.8%				
Newark Liberty International (EWR)	30	458,677	462,202	0.8%				
Phoenix Sky Harbor International (PHX)	31	624,261	627,561	0.5%				
os Angeles International (LAX)	32	781,418	783,160	0.2%				
Sacramento International (SMF)	33	152,205	151,613	-0.4%				
Raleigh-Durham International (RDU)	34	295,649	293,995	-0.6%				
ambert St. Louis International (STL)	35	489,529	486,503	-0.6%				
uscon International (TUS)	36	259,906	258,031	-0.7%				
onululu International (HNL)	37	343,296	339,987	-1.0%				
ndianapolis International (IND)	38	259,861	257,295	-1.0%				
alt Lake City International (SLC)	39	369,343	363,682	-1.5%				
ansas City International (MCI)	40	219,388	215,833	-1.6%				
ouisville International-Standiford Field (SDF)	41	180,819	177,643	-1.8%				
Burbank-Glendale-Pasadena (BUR)	42	162,867	159,832	-1.9%				
Philadelphia International (PHL)	43	484,963	475,577	-1.9%				

Table B-6 continued

# Changes in Operations (Fiscal Year)

			changes in Operations (Fiscal Year)						
Airport (ID)	Rank	2000	2001	Change from 2000					
Savannah International (SAV)	44	112,449	110,104	-2.1%					
Boston Logan International (BOS)	45	510,113	499,474	-2.1%					
Minneapolis-St. Paul International (MSP)	46	524,261	512,102	-2.3%					
Hartsfield Atlanta International (ATL)	47	922,016	898,899	-2.5%					
Houston William B. Hobby (HOU)	48	254,900	248,111	-2.7%					
Birmingham (BHM)	49	154,143	149,996	-2.7%					
Louis Armstrong New Orleans International (MSY)	50	167,016	162,507	-2.7%					
(noxville McGhee-Tyson (TYS)	51	151,965	147,689	-2.8%					
ampa International (TPA)	52	277,888	269,948	-2.9%					
Jashville International (BNA)	53	249,145	241,280	-3.2%					
Palm Springs Regional (PSP)	54 101,147 97,620		-3.5%						
Bradley International (BDL)	55	176,629	170,322	-3.6%					
Dallas-Love Field (DAL)	56	259,106	249,823	-3.6%					
Detroit Metropolitan Wayne County (DTW)	57	561,123	540,966	-3.6%					
ihue (LIH)	58	112,198	108,013	-3.7%					
ittle Rock Adams Field (LIT)	59	180,547	173,476	-3.9%					
Sarasota Bradenton (SRQ)	60	174,782	167,596	-4.1%					
as Vegas McCarran International (LAS)	61	535,935	513,679	-4.2%					
ed Stevens Anchorage International (ANC)	62	319,235	304,988	-4.5%					
ulsa International (TUL)	63	204,940	195,669	-4.5%					
allas-Fort Worth International (DFW)	64	875,673	835,748	-4.6%					
tonald Reagan National (DCA)	65	344,092	328,340	-4.6%					
lorman Y. Mineta San José International (SJC)	66	299,237	285,507	-4.6%					
eattle-Tacoma International (SEA)	67	444,630	423,903	-4.7%					
acksonville International (JAX)	68	149,705	142,561	-4.8%					
Milwaukee General Mitchell International (MKE)	69	225,426	214,549	-4.8%					
ortland International (PDX)	70	321,114	304,896	-5.1%					
lew York John F. Kennedy International (JFK)	71	358,977	340,459	-5.2%					
Miami International (MIA)	72	516,009	489,058	-5.2%					
.F. Green (PVD)	73	157,228	148,800	-5.4%					
ackson International (JAN)	74	97,610	92,324	-5.4%					
ahului (OGG)	75	176,156	165,832	-5.9%					
harleston AFB International (CHS)	76	140,021	131,638	-6.0%					
loise Air Terminal (BOI)	77	174,892	164,390	-6.0%					
leno Tahoe International (RNO)	78	151,589	142,119	-6.2%					
spokane International (GEG)	79	119,210	111,739	-6.3%					
reater Rochester International (ROC)	80	185,180	173,371	-6.4%					
ohn Wayne-Orange County (SNA)	81	412,048	385,742	-6.4%					
Des Moines International (DSM)	82	129,896	121,469	-6.5%					
Orlando International (MCO)	83	367,367	342,315	-6.8%					
San Francisco International (SFO)	84	437,763	407,040	-7.0%					
Chicago Midway (MDW)	85	301,879	280,527	-7.1%					
Madison/Dane County Regional (MSN)	86	134,703	124,429	-7.6%					

Table B-6 continued

# Changes in Operations (Fiscal Year)

Airport (ID)	Rank	2000	2001	Change from 2000
Dayton International (DAY)	87	148,085	135,992	-8.2%
San Antonio International (SAT)	88	255,622	234,423	-8.3%
El Paso International (ELP)	89	141,768	129,438	-8.7%
Gerald R. Ford International (GRR)	90	140,394	127,903	-8.9%
Cleveland Hopkins International (CLE)	91	336,635	305,299	-9.3%
Norfolk International (ORF)	92	133,482	120,438	-9.8%
Hilo International (ITO)	93	116,375	103,169	-11.3%
Washington Dulles International (IAD)	94	495,717	430,082	-13.2%
Colorado Springs Municipal (COS)	95	230,677	199,364	-13.6%
Myrtle Beach International (MYR)	96	77,775	67,119	-13.7%
San Juan Luis Muñoz Marín International (SJU)	97	245,931	210,050	-14.6%
Metropolitan Oakland International (OAK)	98	478,558	403,399	-15.7%
Omaha Eppley Airfield (OMA)	99	178,173	147,163	-17.4%
Greater Cincinnati International (CVG)	national (CVG) 100 485,191		390,306	-19.6%
Total Top 100		28,441,797	27,667,118	-2.7%

Source: APO-130

APPENDIX C
CAPACITY ENHANCEMENT PLAN
UPDATE

 Table C-1
 Airport Capacity Recommendations – Airfield

R – Reci	ommendations											
C – Com												
	Longer in Consideration	Year		≥ .	≥					<u> </u>	ng	
14 140 1	Longor in Constactation	Plan		Runwa	Зипма					Stagir	Stagi	
Region	Airport (ID)	Capacity Enhancement Plan Year	New Runway	Construct 3rd Parallel Runway	Construct 4th Parallel Runway	Relocate Runway	New Taxiway	Runway Extension	Taxiway Extension	Angled Exits/Improved Staging	Holding Pads/Improved Staging	Terminal Expansion
AAL	Ted Stevens Anchorage International (ANC)	00										
ACE	Boise Air Terminal (BOI)	01		R								
	Kansas City International (MCI)	90		R	N				С	R	R	R
	Lambert St. Louis International (STL)	88		R					С	R	R	
AEA	Greater Pittsburgh International (PIT)	91			R			С				С
	Newark Liberty International (EWR)	99	R	R				С				
	New York John F Kennedy International (JFK)	02										
	New York LaGuardia (LGA)	02										
	Norfolk International (ORF)	94	R					R				
	Philadelphia International (PHL)	91		R		N		N			R	R
	Richmond International (RIC)	94						R		R		
	Washington Dulles International (IAD)	90		R			С	С	С		С	R
AGL	Chicago Midway (MDW)	91					R	С			С	R
	Chicago O'Hare International (ORD)	91				R	N	R		С	С	
	Cleveland Hopkins International (CLE)	94		N		R	R	R	R	R	R	R
	Detroit Metropolitan Wayne County (DTW)	88			R		R			R	С	R
	Indianapolis International (IND)	93		R	R	С	R		С	R	С	
	Minneapolis-St. Paul International (MSP)	93		R			С	С		R	R	R
	Port Columbus International (CMH)	93		R	N	R	R	С		R	R	R
ANE	Boston Logan International (BOS)	92	R				R	N	N	R	С	
ANM	Portland International (PDX)	96					С		R	С		
	Salt Lake City International (SLC)	91		С					С	С	R	R
	Seattle-Tacoma International (SEA)	91		R						С		
	Seattle-Tacoma International (SEA) — Update	95										
ASO	Charlotte-Douglas International (CLT)	91		R	R			С	R	С	R	
	Charlotte-Douglas International (CLT)	95										
	Fort Lauderdale-Hollywood International (FLL)	93					R	R		R	R	R
	Hartsfield Atlanta International (ATL) – Update	95			R					R	R	R
	Hartsfield Atlanta International (ATL)	87					С			С	С	С
	Memphis International (MEM)	88		С			С	R	С	R		
	Memphis International (MEM) – Update Study	97					R	R	R	R	R	
	Miami International (MIA)	89							N	C	C	
	Miami International (MIA) – Update Study	97		R								R
	Nashville International (BNA)	91			R	С	C	R	R		R	

Region	Airport (ID)	Capacity Enhancement Plan Year	New Runway	Construct 3rd Parallel Runway	Construct 4th Parallel Runway	Relocate Runway	New Taxiway	Runway Extension	Taxiway Extension	Angled Exits/Improved Staging	Holding Pads/Improved Staging	Terminal Expansion
ASO	Orlando International (MCO)	90			R		R		С		R	
	Orlando-Sanford International (SFB)	99										
	Orlando-Sanford International (SFB)	00										
	Orlando-Sanford International (SFB)	01	R									
	Raleigh-Durham International (RDU)	91		R	N	N	R			R	R	
	San Juan Luis Muñoz Marín International (SJU)	91					R		R	С	R	С
	Tampa International (TPA)	00	R	R			R	R	R	R	R	R
ASW	Albuquerque International (ABQ)	93					С	С	С	С	R	R
	Dallas-Fort Worth International (DFW)	94					С	R		С		
	George Bush Intercontinental (IAH)	93		R	R		R	R	R	R	R	R
	New Orleans International (MSY)	92	R	R			R					
	San Antonio International (SAT)	92		R			R	R	R		С	
AWP	Honolulu International (HNL)	92		R				R		R	R	R
	Las Vegas McCarran International (LAS)	94					R	С	С		С	R
	Los Angeles International (LAX)	91					С	R	С	R	С	R
	Metropolitan Oakland International (OAK)	87					R			R	R	
	Phoenix Sky Harbor International (PHX)	89		R			R		С	R	С	С
	San Francisco International (SFO)	87		N	N			R	С	R	R	С
	Norman Y. Mineta San José International (SJC)	87						С		С	С	

 Table C-2
 Airport Capacity Recommendations – Facilities and Equipment Improvements

D D											
	ommendations										
C – Con	ipleted Longer in Consideration	ear					adar				
		Capacity Enhancement Plan Year	Install/Upgrade ILS	Install/Upgrade RVRs	Install/Upgrade Lighting	Install/Upgrade VOR	Upgrade Terminal Approach Radar	install ASDE	Install/Upgrade PRM	чс	Wake Vortex Advisory System
Region	Airport (ID)	Сарас	Install	Instal	Install	Instal	Upgra	Instal	Install	New A	Wake
AAL	Ted Stevens Anchorage International (ANC)	00									
ACE	Boise Air Terminal (BOI)	01									
	Kansas City International (MCI)	90	R	R				С			
	Lambert St. Louis International (STL)	88	R		R			С			R
AEA	Greater Pittsburgh International (PIT)	91	С						R		
	Newark Liberty International (EWR)	99		R							
	New York John F Kennedy International (JFK)	02	R		С			R	R		
	New York LaGuardia (LGA)	02	R		R				R		R
	Norfolk International (ORF)	94	R	R	R						
	Philadelphia International (PHL)	91	R	R					R		•••••
	Richmond International (RIC)	94	R	R	R						
	Washington Dulles International (IAD)	90		С	С						•••••
AGL	Chicago Midway (MDW)	91									
	Chicago O'Hare International (ORD)	91	С	R							
	Cleveland Hopkins International (CLE)	94	R			R			R		
	Detroit Metropolitan Wayne County (DTW)	88	R	R							
	Indianapolis International (IND)	93	R	С	R			R			
	Minneapolis-St. Paul International (MSP)	93	R	С	R	С			С		
	Port Columbus International (CMH)	93	С		R			R	R	R	
ANE	Boston Logan International (BOS)	92	R								R
ANM	Portland International (PDX)	96	С								•••••
	Salt Lake City International (SLC)	91	С	С	С			С	R		•••••
	Seattle-Tacoma International (SEA)	91	R								R
	Seattle-Tacoma International (SEA) - Update	95								R R	
ASO	Charlotte-Douglas International (CLT)	91	R		R			R	R		
	Charlotte-Douglas International (CLT)	95									
	Fort Lauderdale-Hollywood International (FLL)	93	R			R	С		R		R
	Hartsfield Atlanta International (ATL) - Update	95	R						R		R
	Hartsfield Atlanta International (ATL)	87	С	С	С		С	С	R		R
	Memphis International (MEM)	88	С								
	Memphis International (MEM) - Update Study	97	R						R		R
	Miami International (MIA)	89	С	С	С			С			
	Miami International (MIA) - Update Study	97	R								R
	Nashville International (BNA)	91	C								R

Region	Airport (ID)	Capacity Enhancement Plan Year	Install/Upgrade ILS	Install/Upgrade RVRs	Install/Upgrade Lighting	Install/Upgrade VOR	Upgrade Terminal Approach Radar	Install ASDE	Install/Upgrade PRM	New ATC	Wake Vortex Advisory System
ASO	Orlando International (MCO)	90	R			R		R	R		
	Orlando-Sanford International (SFB)	99									
	Orlando-Sanford International (SFB)	00	С								
	Orlando-Sanford International (SFB)	01									
	Raleigh-Durham International (RDU)	91	R	R				R			R
	San Juan Luis Muñoz Marín International (SJU)	91			R	С				С	R
	Tampa International (TPA)	00	R	R	R		R	R			
ASW	Albuquerque International (ABQ)	93	С			R					
	Dallas-Fort Worth International (DFW)	94									
	George Bush Intercontinental (IAH)	93	R	R	R					С	
	New Orleans International (MSY)	92				R				С	
	San Antonio International (SAT)	92	С	С	R				R		R
AWP	Honolulu International (HNL)	92	R								
	Las Vegas McCarran International (LAS)	94	R								
	Los Angeles International (LAX)	91	С							С	
	Metropolitan Oakland International (OAK)	87									
	Phoenix Sky Harbor International (PHX)	89	С		R	С					
	San Francisco International (SFO)	87						С	R		
	Norman Y. Mineta San José International (SJC)	87									

 Table C-3
 Airport Capacity Recommendations – Operational Improvements

	ommendations					so	Runways				System
C — Completed  N — No Longer in Consideration		ment Plan Year	ure/Analysis	Procedures	ıcing	ons BTW Arrival:	ations with Wet I	stablish TCA		chedules	and GA Airport
Region	Airport (ID)	Capacity Enhancement Plan Year	Airspace Restructure/Analysis	IFR Approach Proc	Departure Sequencing	Reduced Separations BTW Arrivals	Intersecting Operations with Wet Runways	Expand TRACON/Establish TCA	Segregate Traffic	De-peak Airline Schedules	Enhance Reliever and GA Airport System
AAL	Ted Stevens Anchorage International (ANC)	00	R								
ACE	Boise Air Terminal (BOI)	01									
	Kansas City International (MCI)	90	R		R					R	
	Lambert St. Louis International (STL)	88	С		С					N	
AEA	Greater Pittsburgh International (PIT)	91	R		••••••						
	Newark Liberty International (EWR)	99									
	New York John F Kennedy International (JFK)	02									
	New York LaGuardia (LGA)	02									
	Norfolk International (ORF)	94				R					
	Philadelphia International (PHL)	91	R	R	R		R				
	Richmond International (RIC)	94		R		R					
	Washington Dulles International (IAD)	90		С		С				N	N
AGL	Chicago Midway (MDW)	91		R		R					
	Chicago O'Hare International (ORD)	91					С				
	Cleveland Hopkins International (CLE)	94		R	R	R		R			R
	Detroit Metropolitan Wayne County (DTW)	88		R							
	Indianapolis International (IND)	93		С	R	R					R
	Minneapolis-St. Paul International (MSP)	93	С			С					R
	Port Columbus International (CMH)	93	R	R		R	• • • • • • • • • • • • • • • • • • • •			R	R
ANE	Boston Logan International (BOS)	92		С			R		•••••		
ANM	Portland International (PDX)	96		R	R	С			R		
	Salt Lake City International (SLC)	91		С		С					R
	Seattle-Tacoma International (SEA)	91		R		С			•	N	
	Seattle-Tacoma International (SEA) - Update	95									
ASO	Charlotte-Douglas International (CLT)	91				R	С				R
	Charlotte-Douglas International (CLT)	95									
	Fort Lauderdale-Hollywood International (FLL)	93	R	R		R				R	R
	Hartsfield Atlanta International (ATL) - Update	95				R					R
	Hartsfield Atlanta International (ATL)	87				С				N	
	Memphis International (MEM)	88		С		N				N	
	Memphis International (MEM) - Update Study	97		С		R					R
	Miami International (MIA)	89		С							С
	Miami International (MIA) - Update Study	97	R			R				С	
	Nashville International (BNA)	91	С	R				R		N	R

Table C-3 continued

Region	Airport (ID)	Capacity Enhancement Plan Year	Airspace Restructure/Analysis	IFR Approach Procedures	Departure Sequencing	Reduced Separations BTW Arrivals	Intersecting Operations with Wet Runways	Expand TRACON/Establish TCA	Segregate Traffic	De-peak Airline Schedules	Enhance Reliever and GA Airport System
ASO	Orlando International (MCO)	90	С	R					R		R
	Orlando-Sanford International (SFB)	99	С								
	Orlando-Sanford International (SFB)	00									
	Orlando-Sanford International (SFB)	01									
	Raleigh-Durham International (RDU)	91	R	R		R		R			
	San Juan Luis Muñoz Marín International (SJU)	91				R					R
	Tampa International (TPA)	00		R	R	R					С
ASW	Albuquerque International (ABQ)	93		R		R					R
	Dallas-Fort Worth International (DFW)	94		С	С	С					С
	George Bush Intercontinental (IAH)	93		R	R					R	R
	New Orleans International (MSY)	92	R	С		С					С
	San Antonio International (SAT)	92	R	R		R					R
AWP	Honolulu International (HNL)	92								R	С
	Las Vegas McCarran International (LAS)	94		R			R				С
	Los Angeles International (LAX)	91	R								
	Metropolitan Oakland International (OAK)	87									
	Phoenix Sky Harbor International (PHX)	89		R	R	R			R	R	С
	San Francisco International (SFO)	87			С		С		R	R	С
	Norman Y. Mineta San José International (SJC)	87			С						

APPENDIX D
RUNWAY PROJECTS 2008

 Table D-1
 Runways Planned, Proposed, or Currently Under Construction at the 100 Busiest Airports for 2008 and Beyond

Airport (ID)	New	Extension	Runway Identifier	Estimated Cost (\$M)	Planned Operational Year	In Progress
Indianapolis International (IND)	•		5R/23L	\$80.0	2008	
Baltimore-Washington International (BWI)	•		10R/28L	\$150.0	2010	
Greenville-Spartanburg (GSP)	•		3R/21L	\$65.0	2010	
Hilo International (ITO)		•	8/26	\$25.0	2010	
Louis Armstrong New Orleans International (MSY)	•		18/36	\$400.0	2010	
Oklahoma City Will Rogers World (OKC)		•	13/31	\$11.2	2010	
Fort Myers Southwest Florida Regional (RSW)	•		6R/24L	\$80.0	2010	
Tulsa International (TUL)	•		18/36	\$115.0	2010	
Jacksonville International (JAX)	•		7R/25L	\$50.0	2011	
Oklahoma City Will Rogers World (OKC)	•		17/35	\$13.0	2012	
Denver Stapleton International (DEN)	•		8L/26R	\$285.0	2013	
Oklahoma City Will Rogers World (OKC)		•	17R/35L	\$8.0	2014	
Oklahoma City Will Rogers World (OKC)		•	17L/35R	\$8.0	2014	
Tampa International (TPA)	•		17/35	\$150.0	TBD	
Boise Air Terminal (BOI)	•		10R/28L	TBD	2015	
Milwaukee General Mitchell International (MKE)	•		7/25	\$160.0	2015	
Port Columbus International (CMH)	•		10S/28S	\$128.0	2020	
Grand Rapids Kent County International (GRR)	•		8L/26R	TBD	2020	
Savannah International (SAV)	•		9L/27R	\$20.0	2020	
Washington Dulles International (IAD)	•		12R/30L	\$200.0	TBD	
Sarasota-Bradenton (SRQ)	•		14L/32R	\$10.0	TBD	
Raleigh-Durham International (RDU)		•	5R/23L	TBD	TBD	
San Antonio International (SAT)	•		12N/30N	\$400.0	TBD	
Tucson International (TUS)	•		11R/29L	\$40.0	TBD	
Charlotte/Douglas International (CLT)		•	18R/36L	\$22.0	TBD	
Tampa International (TPA)		•	9/27	TBD	TBD	
Tampa International (TPA)		•	18L/36R	TBD	TBD	
Nashville International (BNA)	•		2E/20E	TBD	TBD	
Nashville International (BNA)		•	2R/20L	TBD	TBD	
Dayton International (DAY)		•	6L/24R	TBD	TBD	
Spokane International (GEG)	•		3L/21R	TBD	TBD	
George Bush Intercontinental (IAH)	•		9R/27L	TBD	TBD	
Wichita Mid-Continent (ICT)		•	1R/19L	TBD	TBD	
Kansas City International (MCI)		•	1L/19R	\$12.0	TBD	
Orlando International (MCO)		•	17R/35L	TBD	TBD	
Memphis International (MEM)		•	18R/36L	TBD	TBD	
Omaha Eppley Airfield (OMA)		•	14L/32R	TBD	TBD	
Raleigh-Durham International (RDU)	•		5W/23W	TBD	TBD	
Richmond International (RIC)		•	16/34	\$45.0	TBD	
Norman Y. Mineta San José International (SJC)		•	12L/30R	\$54.3	TBD	
Sacramento International (SMF)		•	16R/34L	TBD	TBD	
Sacramento International (SMF)		•	16L/34R	TBD	TBD	
John Wayne-Orange County (SNA)		•	1L/19R	TBD	TBD	

Table D-1 continued

Airport (ID)	New	Extension	Runway Identifier	Estimated Cost (\$M)	Planned Operational Year	In Progress
Lambert St. Louis International (STL)		•	12R/30L	\$50.0	TBD	
Syracuse Hancock International (SYR)		•	10L/28R	\$55.0	TBD	
Syracuse Hancock International (SYR)	•		10R/28L	TBD	TBD	
Knoxville McGhee-Tyson (TYS)		•	5L/23R	\$7.0	TBD	
Knoxville McGhee-Tyson (TYS)		•	5R/23L	TBD	TBD	

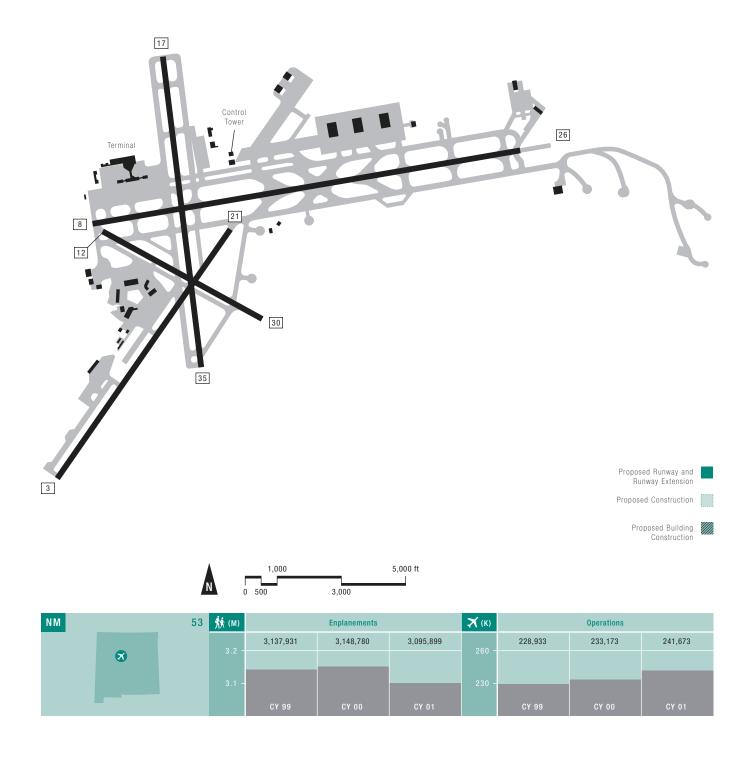
APPENDIX E

AIRPORT LAYOUTS FOR THE

ABQ	Albuquerque International Airport	MCI	Kansas City International Airport	165
ALB	Albany County Airport	MCO	Orlando International Airport	166
ANC	Ted Stevens Anchorage International Airport 117	MDW	Chicago Midway Airport	167
ATL	Hartsfield Atlanta International Airport	MEM	Memphis International Airport	168
AUS	Austin-Bergstrom International Airport	MHT	Manchester Airport	169
BDL	Bradley International Airport	MIA	Miami International Airport	170
BHM	Birmingham Airport	MKE	Milwaukee General Mitchell International Airport	171
BNA	Nashville International Airport	MSN	Madison/Dane County Regional Airport	
BOI	Boise Air Terminal	MSP	Minneapolis-St. Paul International Airport	
BOS	Boston Logan International Airport	MSY	Louis Armstrong New Orleans International Airport	174
BUF	Greater Buffalo International Airport	MYR	Myrtle Beach International Airport	
BUR	Burbank-Glendale-Pasadena Airport 126	OAK	Metropolitan Oakland International Airport	
BWI	Baltimore-Washington International Airport 127	OGG	Kahului Airport	
CHS	Charleston International Airport	OKC	Oklahoma City Will Rogers World Airport	
CLE	Cleveland Hopkins International Airport129	OMA	Omaha Eppley Airfield	
CLT	Charlotte/Douglas International Airport	ONT	Ontario International Airport	
CMH	Port Columbus International Airport	ORD	Chicago O'Hare International Airport	
COS	Colorado Springs Municipal Airport	ORF	Norfolk International Airport	
CVG	Greater Cincinnati International Airport	PBI	Palm Beach International Airport	
DAL	Dallas-Love Field	PDX	Portland International Airport	
DAY	Dayton International Airport	PHL	Philadelphia International Airport	
DCA	Ronald Reagan National Airport	PHX	Phoenix Sky Harbor International Airport	
DEN	Denver International Airport	PIT	Greater Pittsburgh International Airport	
DFW	Dallas-Fort Worth International Airport	PSP	Palm Springs Regional Airport	
DSM	Des Moines International Airport	PVD	T.F. Green Airport	
DTW	Detroit Metropolitan Wayne County Airport	PWM	Portland International Jetport	
ELP	El Paso International Airport	RDU	Raleigh-Durham International Airport	
EWR FLL	Newark Liberty International Airport	RIC	Richmond International Airport	
GEG	Fort Lauderdale-Hollywood International Airport 143	RNO ROC	Reno Tahoe International Airport	
GRR	Spokane International Airport	RSW	Greater Rochester International Airport Fort Myers Southwest Florida Regional Airport	
GS0	Greensboro Piedmont Triad International Airport 146	SAN	San Diego International Lindberg Field	
GSP	Greenville-Spartanburg International	SAT	San Antonio International Airport	
GUM	Guam International Airport	SAV	Savannah International Airport	
HNL	Honolulu International Airport	SDF	Louisville International Airport	
HOU	Houston William P. Hobby Airport	SEA	Seattle-Tacoma International Airport	
IAD	Washington Dulles International Airport	SFB	Orlando-Sanford Airport	
IAH	George Bush International Airport	SF0	San Francisco International Airport	
IND	Indianapolis International Airport	SJC	Norman Y. Mineta San José International Airport	
ISP	Islip Long Island MacArthur Airport	SJU	San Juan Luis Muñoz Marín International Airport	
ITO	Hilo International Airport	SLC	Salt Lake City International Airport	
JAN	Jackson International Airport	SMF	Sacramento International Airport	
JAX	Jacksonville International Airport	SNA	John Wayne Airport - Orange County	
JFK	New York John F. Kennedy International Airport 158	SRQ	Sarasota Bradenton Airport	
KOA	Kona International Airport at Keahole	STL	Lambert St. Louis International Airport	
LAS	Las Vegas McCarran International Airport 160	SYR	Syracuse Hancock International Airport	
LAX	Los Angeles International Airport	TPA	Tampa International Airport	
LGA	New York LaGuardia Airport	TUL	Tulsa International Airport	
LIH	Lihue Airport	TUS	Tucson International Airport	
l IT	Little Bock Adams Field	TYS	Knoxville McGhee-Tyson Airport	

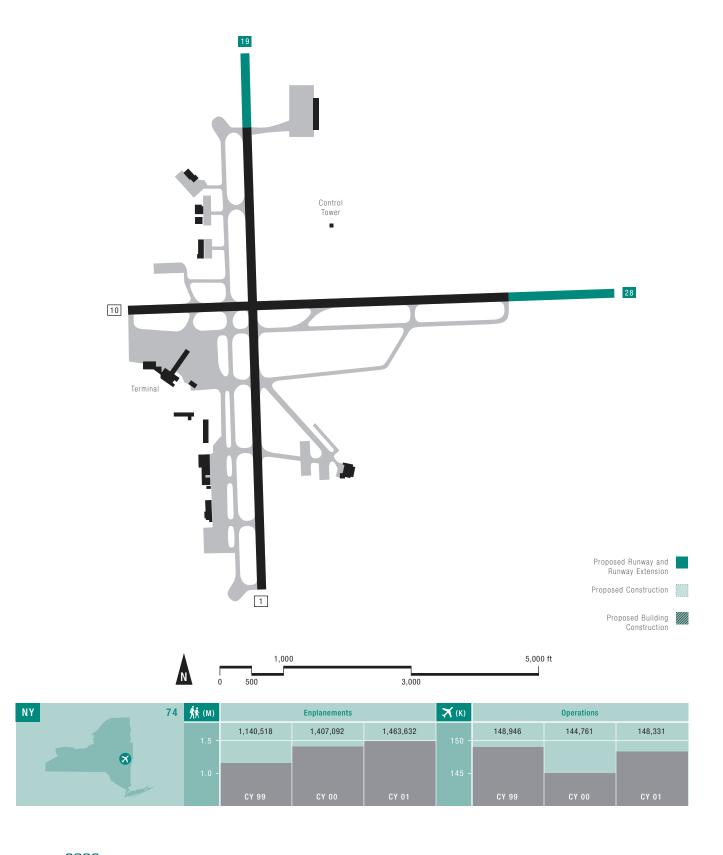
# ABQ - Albuquerque International Airport

There are no new runway or runway extension projects planned, proposed, or currently under construction at this airport.



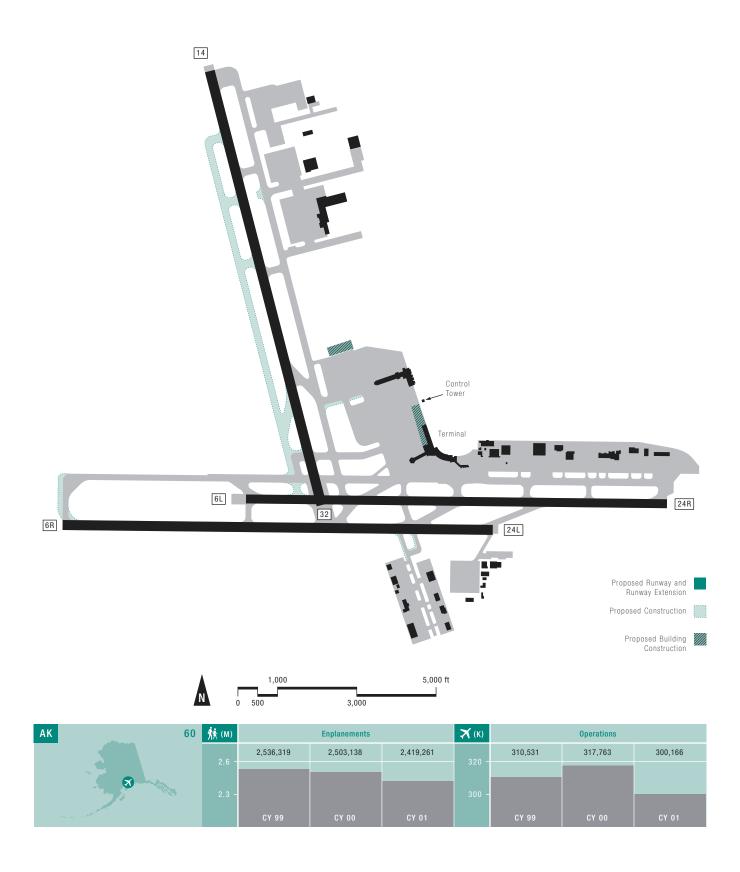
# ALB - Albany County Airport

Construction of an extension to Runway 10/28 is planned. The estimated cost of construction is \$5.8 million and is expected to be completed in 2002. An extension of Runway 1/19 is planned at an estimated cost of \$7.5 million. Completion is expected in 2005.



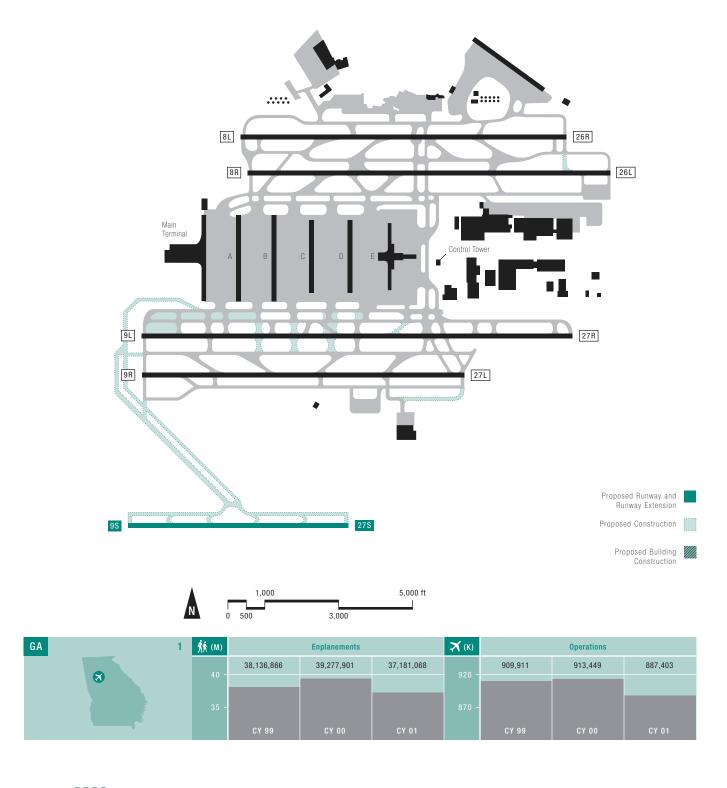
# ANC - Ted Stevens Anchorage International Airport

A new runway, 32L/14R, is being proposed, at a cost of \$16 million. No completion date is available at this time.



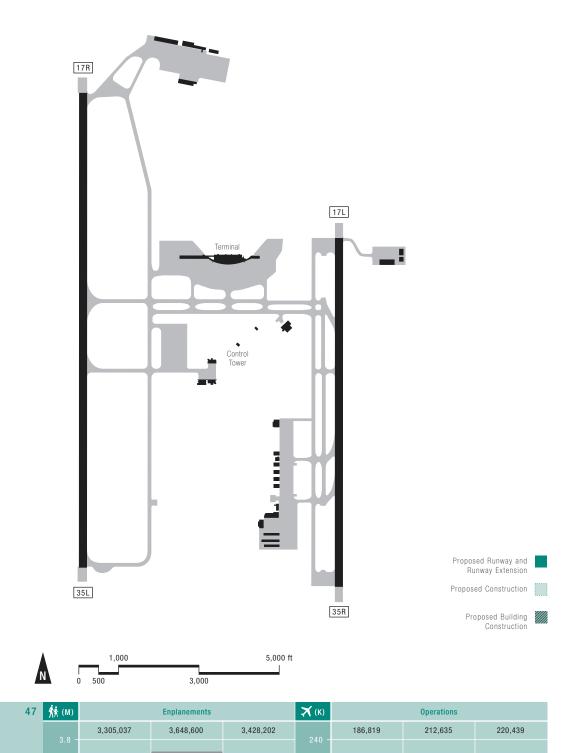
# ATL - Hartsfield Atlanta International Airport

A fifth Runway 10/28, 9,000 ft. long and approximately 4,200 ft. south of Runway 9R/27L, is under design. Land acquisition is ongoing. The runway will permit triple independent IFR approaches using the PRM. The total estimated cost is \$1.2 billion. Construction began in 2000. The estimated operational date is early 2005.



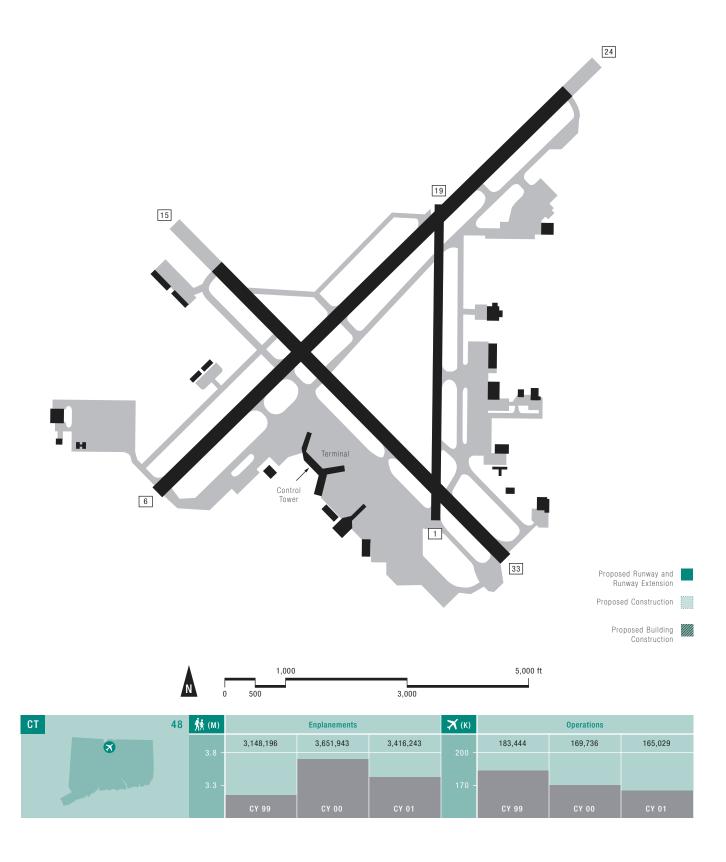
# AUS - Austin-Bergstrom International Airport

There are no new runway or runway extension projects planned, proposed, or currently under construction at this airport.



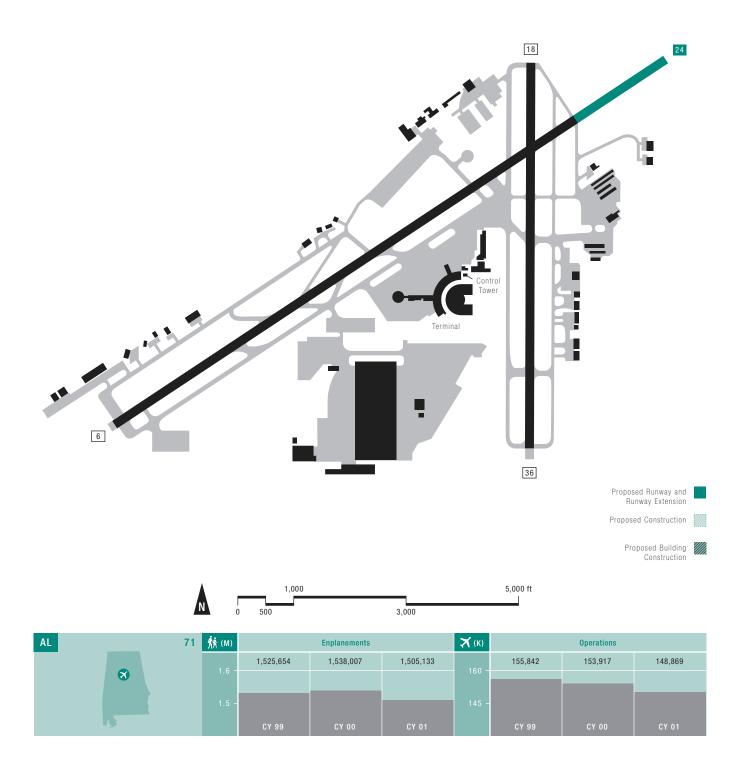
# BDL - Bradley International Airport

There are no new runway or runway extension projects planned, proposed, or currently under construction at this airport.



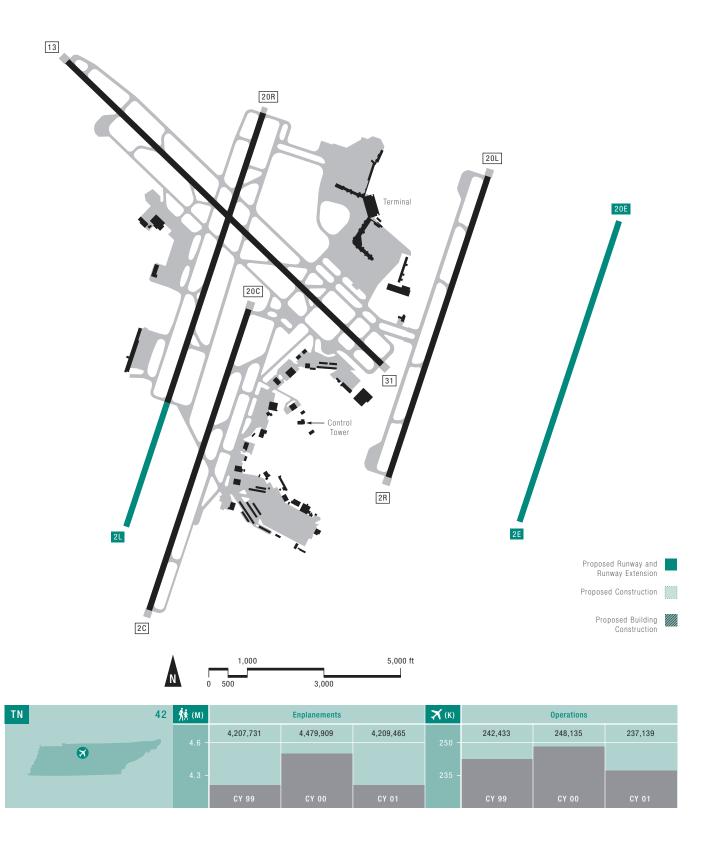
## BHM - Birmingham Airport

A 2,000-ft. extension of Runway 5/23 is currently proposed in the Airport's Master Plan. As proposed, the Runway 23 threshold would be displaced by 2,000 ft. Therefore, Runway 23's length available for departures and arrivals would be 12,000 ft. and 10,000 ft., respectively. Runway 5's available length for both arrivals and departures would increase to 12,000 ft. The increased length will allow increased aircraft payloads. An environmental assessment for the runway extension was completed in 1999. The runway extension is planned to be completed by 2002. The total estimated cost is \$17 million.



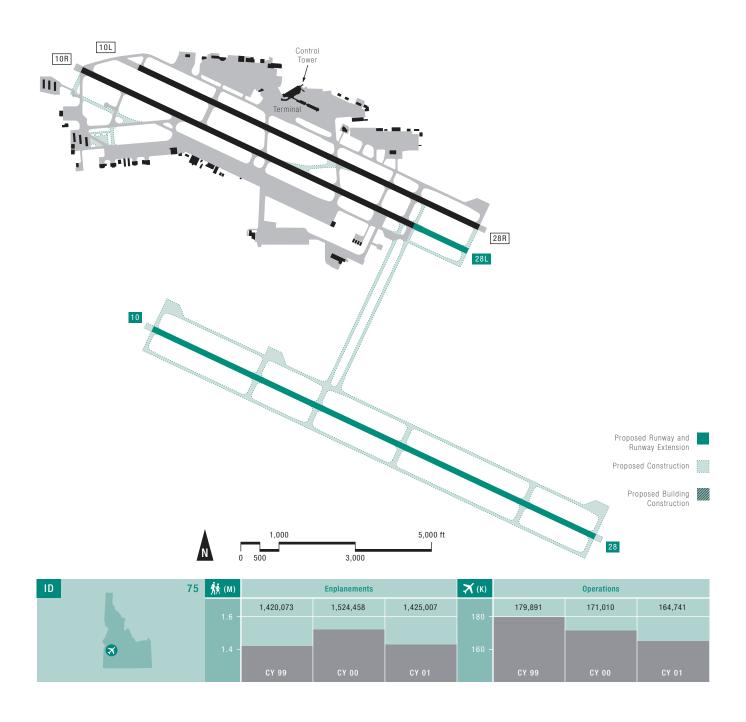
# BNA - Nashville International Airport

A new Runway 2E/20E is planned for the future between 1,500 and 3,500 ft. from Runway 2R/20L. In addition, an extension to Runway 2R/20L is planned.



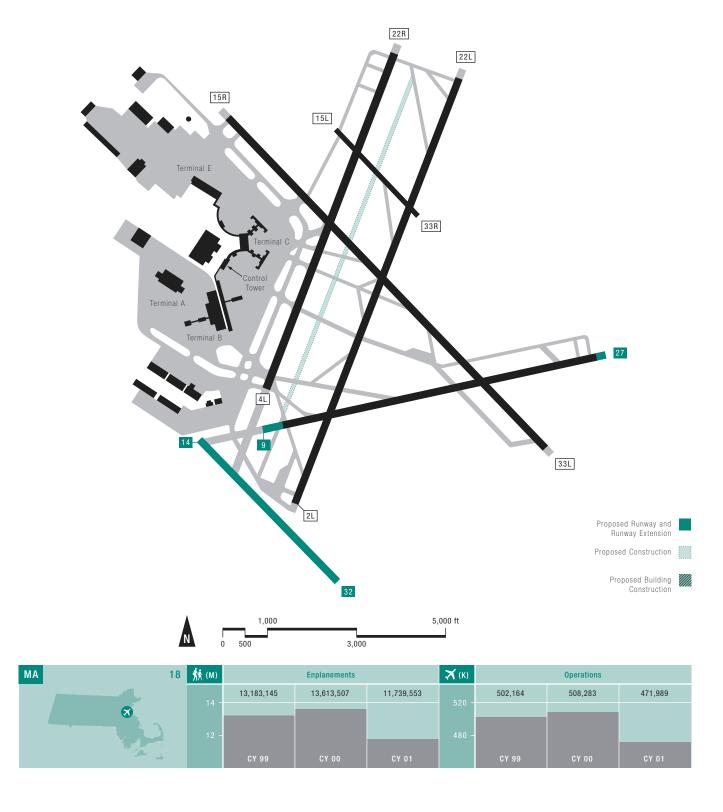
## BOI - Boise Air Terminal

A third parallel Runway 10R/28L is planned for the long-term future. It is planned 5,400 ft. south of existing Runway 10R/28L (to be renamed 10C/28C). A third parallel Runway 9/27 is planned for the long-term future. The eastern 5,000 ft. will be constructed in 2002 for military short-field landing training. The third runway is planned 5,200 ft. south of existing Runway 10R/28L.



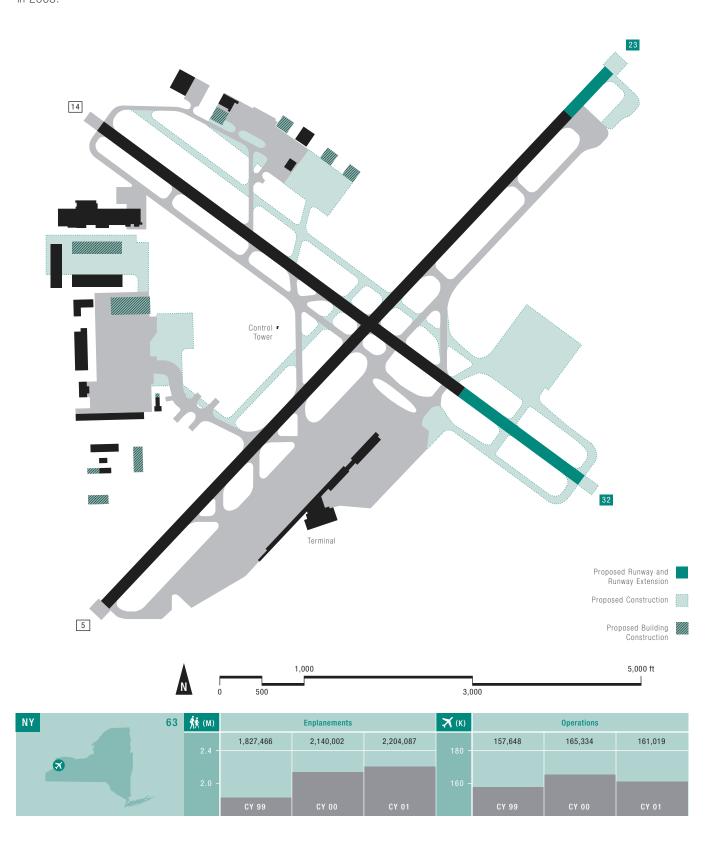
## BOS - Boston Logan International Airport

A new uni-directional 5,000 ft. Commuter Runway 14/32, and a new midfield taxiway, 9000 ft. in length, and other improvements are planned. An Environmental Impact Statement is nearing completion for the airfield project. The estimated cost for construction for the new runway is \$100 million including mitigation. Massport's current plans reflect completion of the new Runway in 2005.



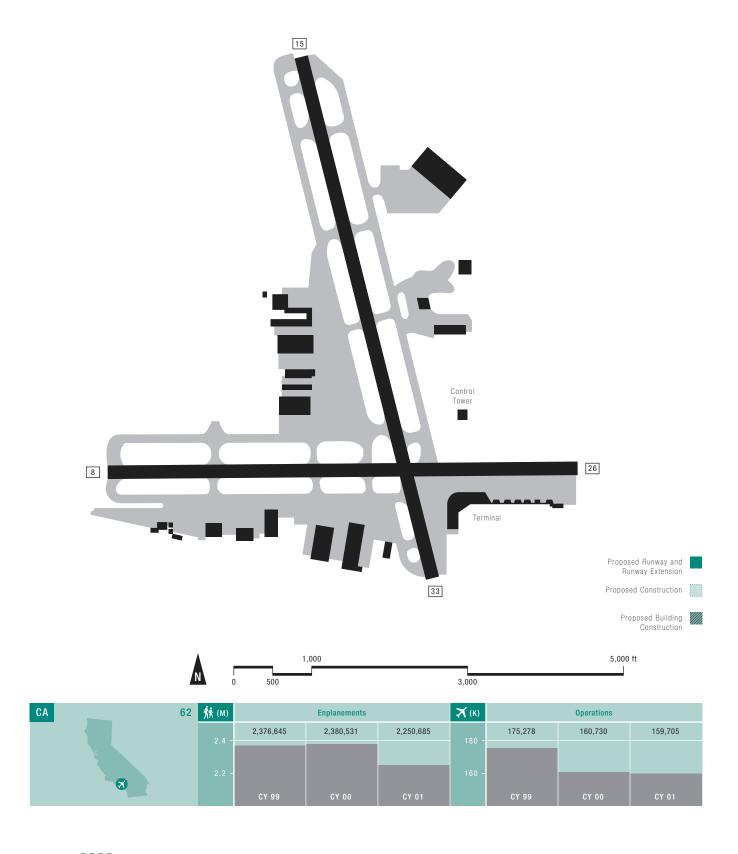
# BUF - Greater Buffalo International Airport

Construction of an extension to Runway 14/32 is planned. Estimated cost of construction is \$4.9 million and it is expected to be completed in 2005.



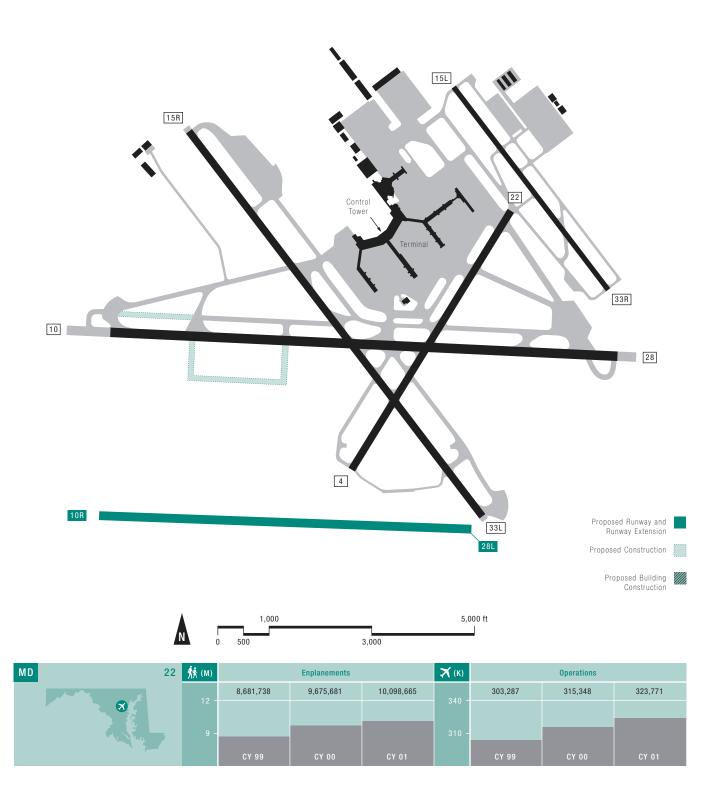
# BUR - Burbank-Glendale-Pasadena Airport

There are no new runway or runway extension projects planned, proposed, or currently under construction at this airport.



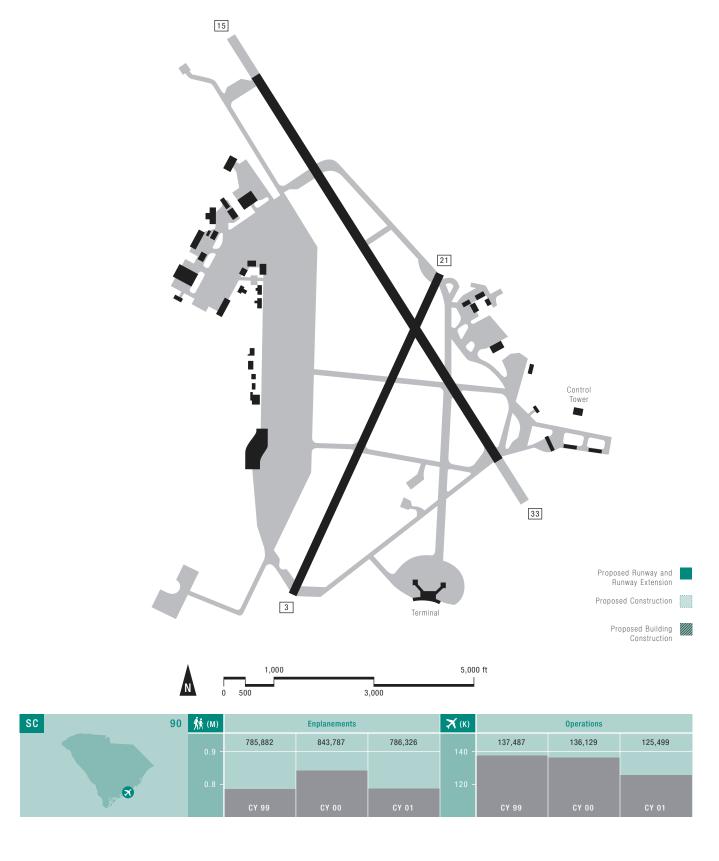
# BWI - Baltimore-Washington International Airport

Various capacity improvements are currently under consideration by the Washington/Baltimore International Airport (BWI) Capacity Task Force. The BWI Capacity Enhancement Plan (CEP) is projected for release in 2002. The CEP will detail several viable proposed capacity improvements and runway alternatives, and identify the anticipated date of project(s) construction.



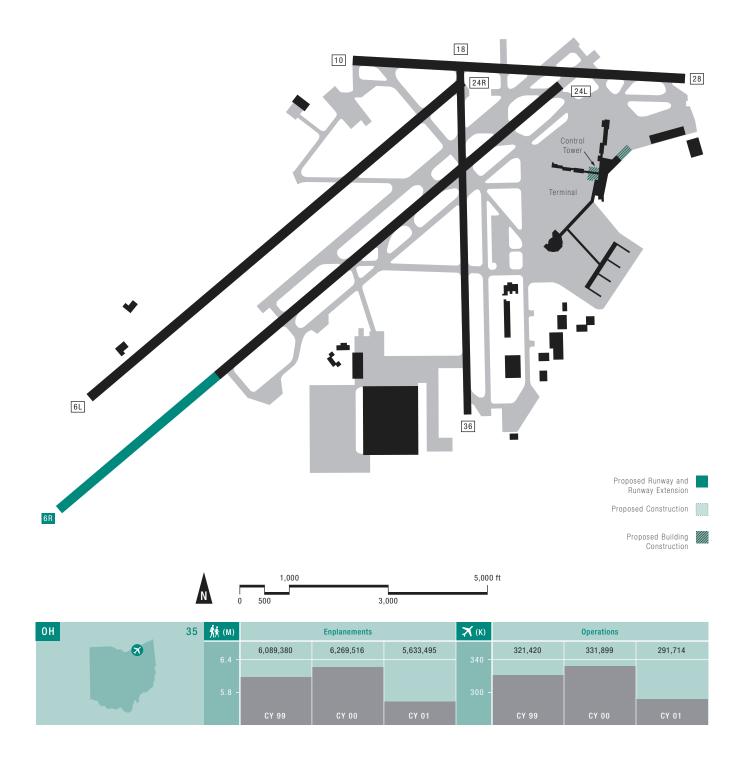
# CHS - Charleston International Airport

There are no new runway or runway extension projects planned, proposed, or currently under construction at this airport.



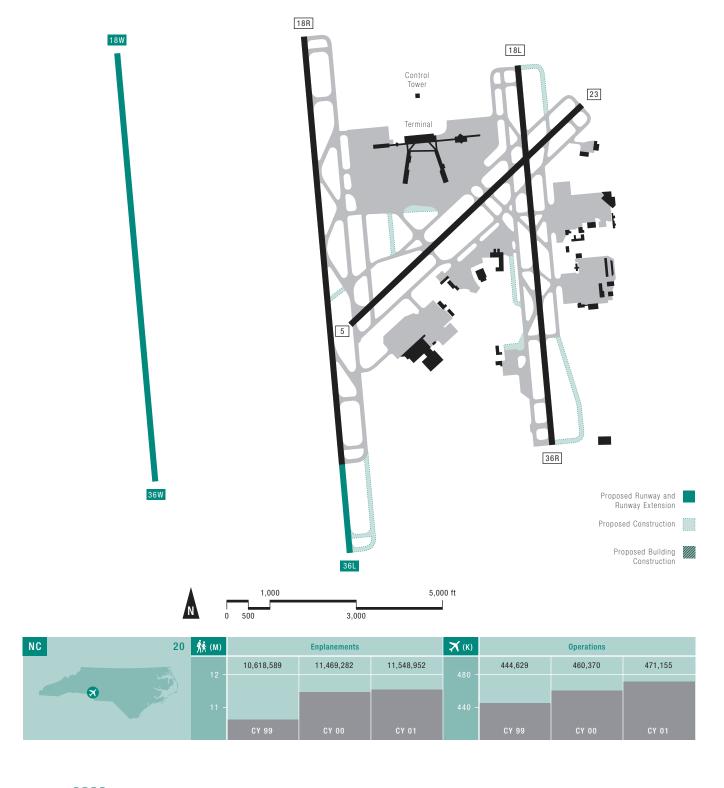
## CLE - Cleveland Hopkins International Airport

The current ALP shows construction of a new Runway 6L/24R that will be 9,000 ft. long. Construction of Phase I, 7,000 ft., is under construction and is expected to be operational in December 2002. Phase II, completing construction to 9,000 ft., is awaiting relocation of existing NASA facilities now in progress and is scheduled to be operational in November 2004. The cost of Phase I and II is \$129 million. Also planned is the conversion of existing 6L/24R into a parallel taxiway at a cost of \$3 million, scheduled for completion 2005. Future projects include an extension of existing Runway 6R/24L from 9,000 ft. to 11,250 ft., at an estimated cost of \$40 million. The schedule is pending, based upon available funding.



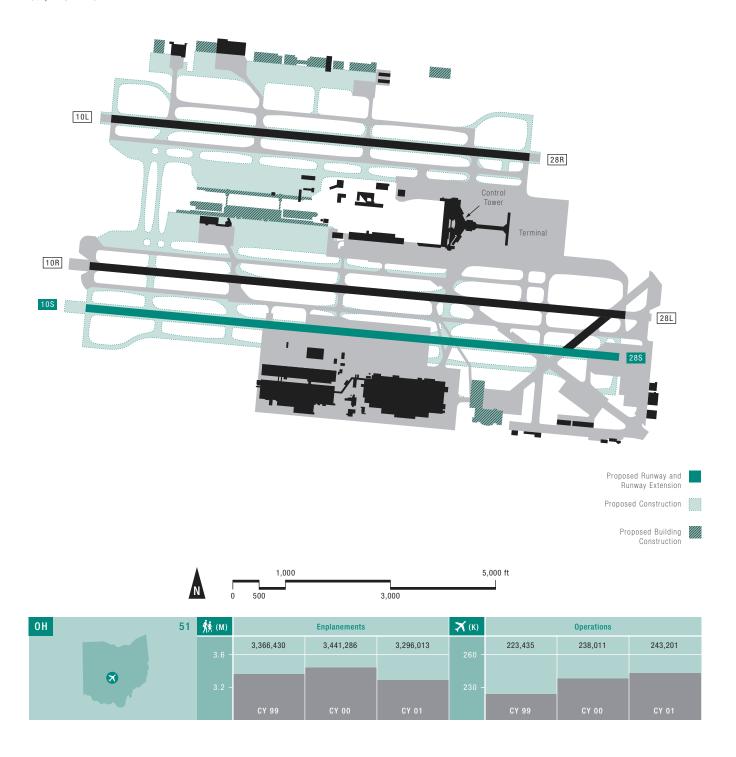
#### CLT - Charlotte/Douglas International Airport

A third parallel 9,000-ft. Runway 18W/36W, 3,700 ft. west of Runway 18R/36L, is being planned. It would permit triple dependent IFR approaches. Land acquisition is ongoing. Construction is expected to start in mid-2002 and be completed by late-2005, at an estimated cost of \$187 million. A 2,000-ft. extension of Runway 18R/36L is also planned. The estimated cost is \$22 million, and it is expected to be operational beyond 2006. The extension is primarily for departures.



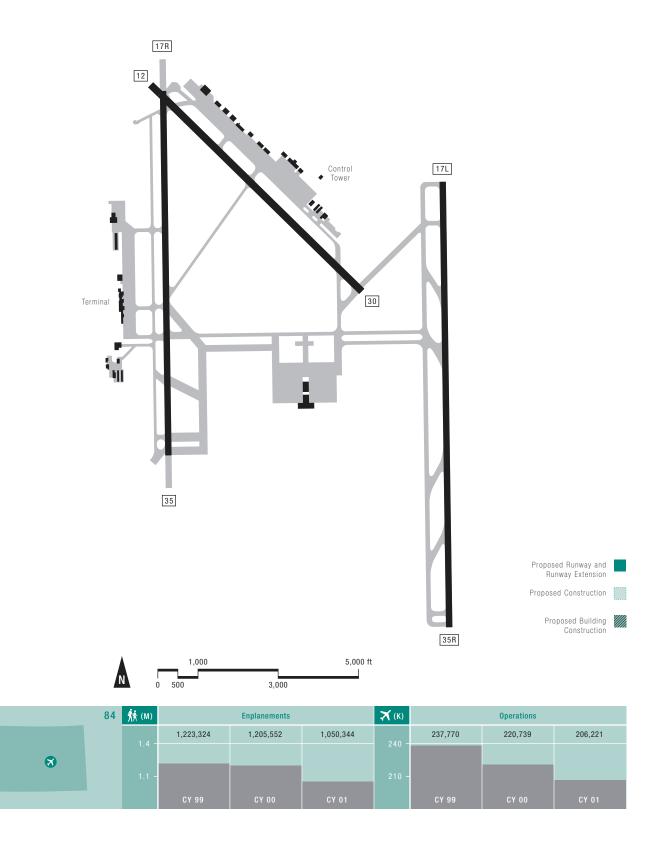
#### CMH - Port Columbus International Airport

The Airport Layout Plan illustrates a third parallel Future Runway 10R/28L, constructed 800 ft. south of the existing Runway 10R/28L. (Existing Runway 10R/28L will become Runway 10C/28C upon completion of construction of the third parallel Future Runway 10R/28L.) The new runway will be 10,125 ft. in length and 150 ft. in width, with two high-speed exits, a 90-degree exit at the center and a 90-degree bypass taxiway at each end. This would provide a 3,600-ft. separation between the proposed Runway 10R/28L and the existing Runway 10L/28R. With the installation of the Precision Runway Monitor (PRM), the existing Runway 10L/28R and the proposed Runway 10R/28L could be used for arrival traffic. Runway 10C/28C would be used as the departure runway. The expected operational date is 2020, with project costs estimated at \$128 million.



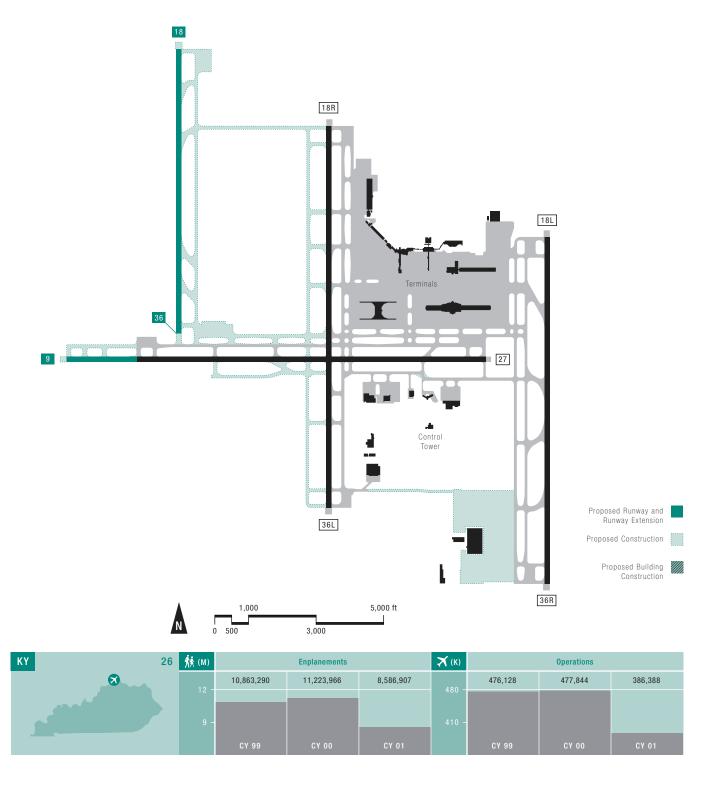
# COS - Colorado Springs Municipal Airport

Runway 17R/35L began reconstruction March 2002 with completion scheduled for November 2002.

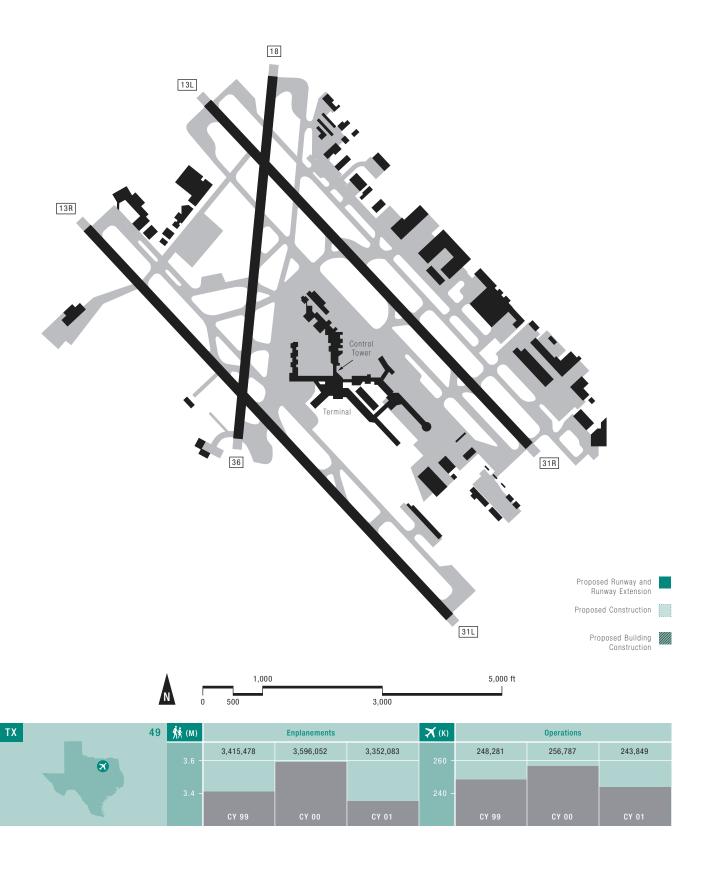


#### CVG - Greater Cincinnati International Airport

A new 8,000 ft. third parallel Runway 18R/36L is planned to be located 4,300 ft. west of the existing Runway 18R/36L (to be renamed 17/35). The estimated cost is \$233 million. The expected operational date is 2005. The new runway may allow triple independent IFR approaches. A 1,000 ft. extension to Runway 9 is required for the new runway to become operational. However, a 2,000 ft. extension is planned and is expected to be completed in 2005 at an estimated cost of \$18.2 million. The extension would allow departures of aircraft with heavier payloads and/or longer haul-lengths. An EIS is currently underway for both projects.

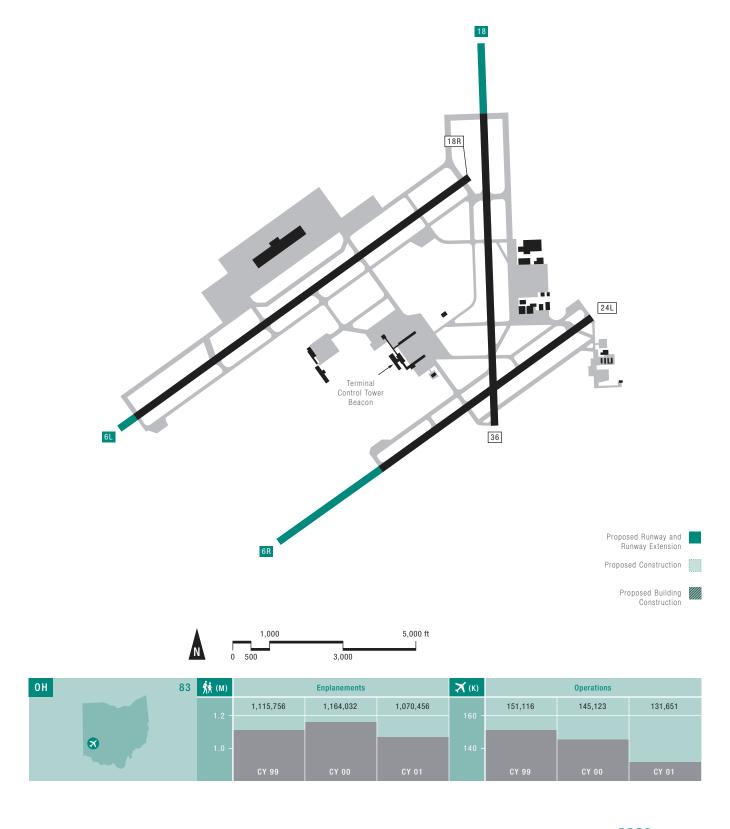


## DAL - Dallas-Love Field



## DAY - Dayton International Airport

Future plan revisions under consideration are: a northerly shift of Runway 18/36 including an extension to Runway 18 end to provide a total length of 9,500 ft.; an additional extension to Runway 6R end to provide a total length of 11,000 ft.

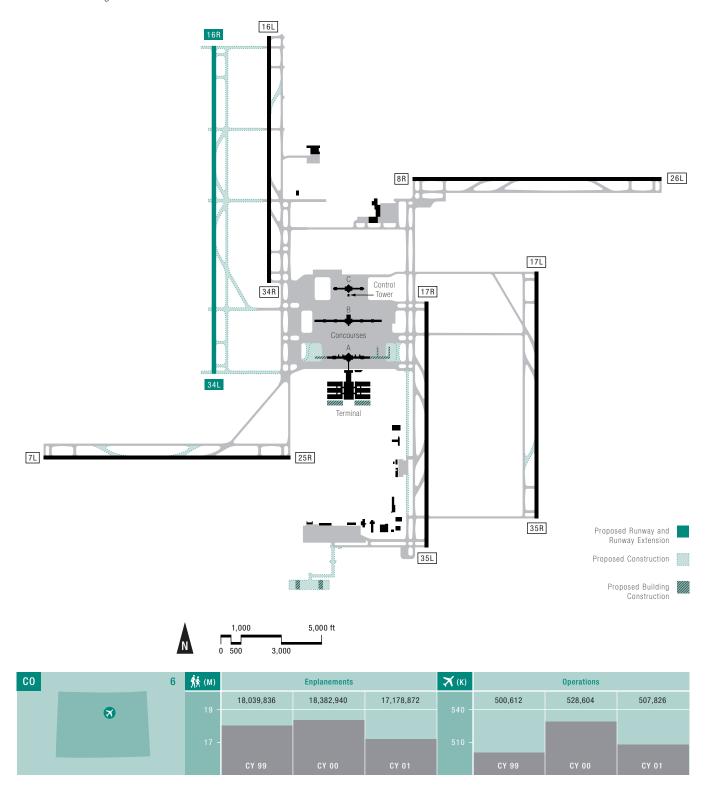


# DCA - Ronald Reagan National Airport



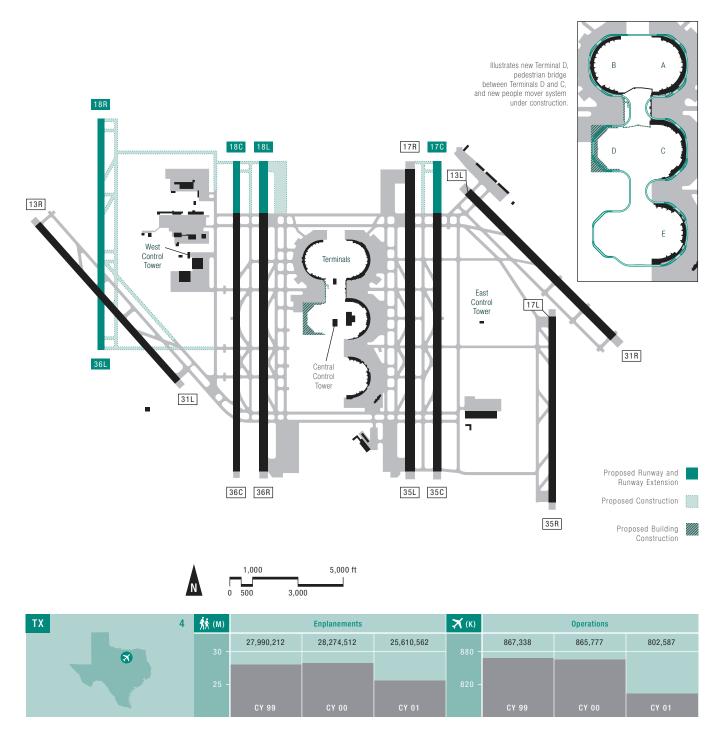
#### DEN - Denver International Airport

Runway 16R/34L is the last of the six original runways to be built at the new airport. It will be separated 2,600 ft. from Runway 16L/34R, and be 16,000 ft. in length and is designed to accommodate Group VI aircraft. The runway is under construction and is expected to be completed in 2003 at an estimated cost of \$150 million. Other airfield construction being completed in FY 2002 includes cross-field Taxiway EA and a new de-icing Pad J.



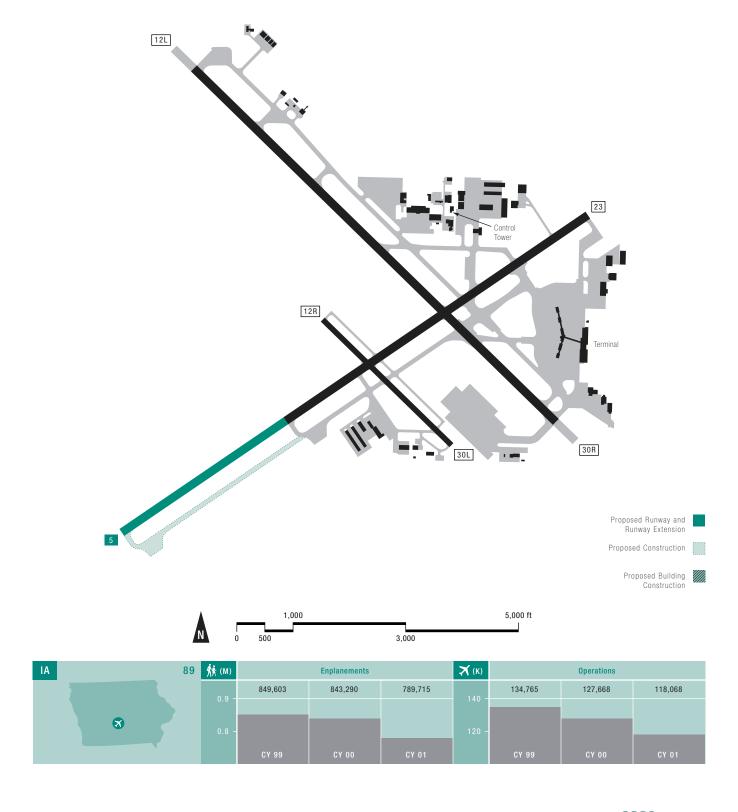
#### DFW - Dallas-Fort Worth International Airport

Proposed 2,000-ft. extensions to all of the north/south parallel runways will provide an overall length of 13,400 ft. for each. All extensions are expected to be completed by 2005. The estimated cost of the extensions is \$95 million. A terminal expansion program has recently been completed that added five new jet departure gates to the south side of Terminal 2W; provided baggage and passenger connections to Terminal 2E; and renovated a portion of Terminal 2W. Construction on the new west runway, Runway 18R/36L, will begin when warranted by aviation demand. It could be available as early as 2005. The estimated cost is \$400 million. It will be located 5,800 ft. west of the existing Runway 18R/36L (to be renamed 18C/36C), and will be used primarily for arrivals. The addition of Runway 18R/36L will allow DFW to accommodate quadruple simultaneous precision instrument approaches.



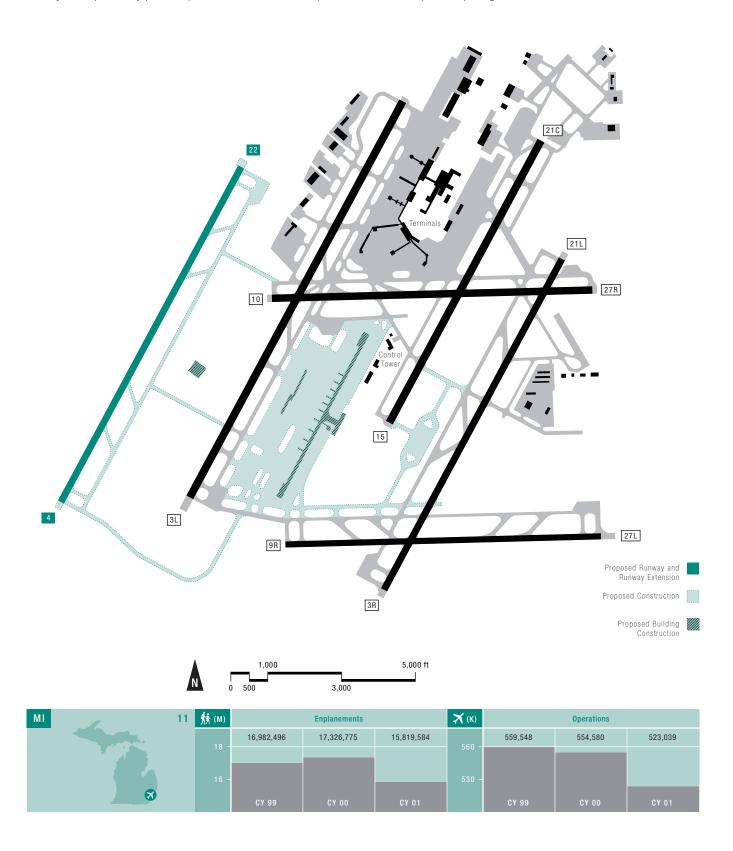
## DSM - Des Moines International Airport

Construction began in 1997 for a southwest extension of Runway 5/23, and was completed in 2001. Cost for construction is estimated at \$31 million, with an additional estimated \$23 million for road relocation.



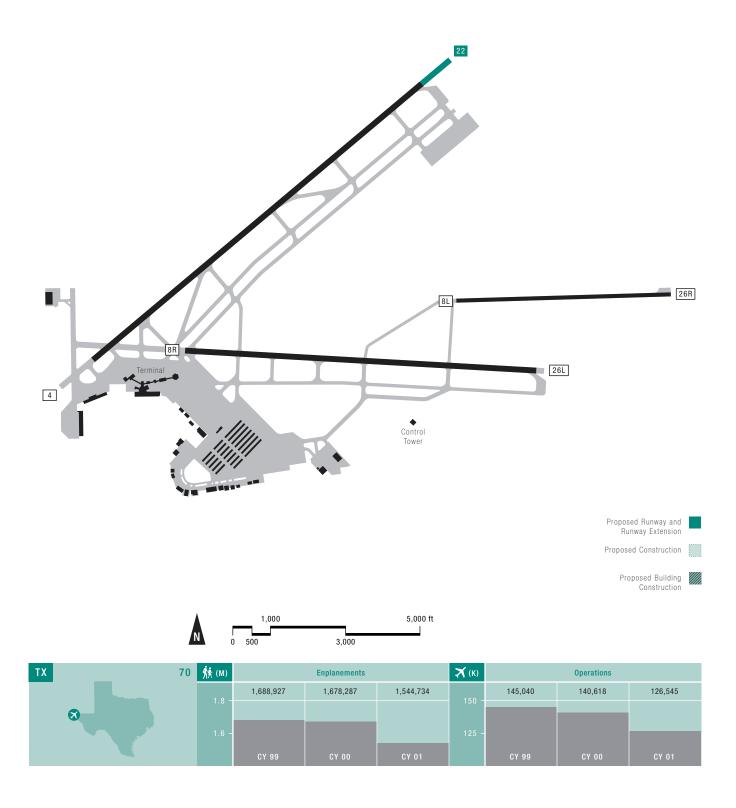
## DTW - Detroit Metropolitan Wayne County Airport

A fourth north-south parallel, Runway 4/22 began in 1999 and was completed in 2001. The cost of construction was \$116.5 million. This runway could potentially permit triple IFR arrivals with one dependent and one independent pairing.



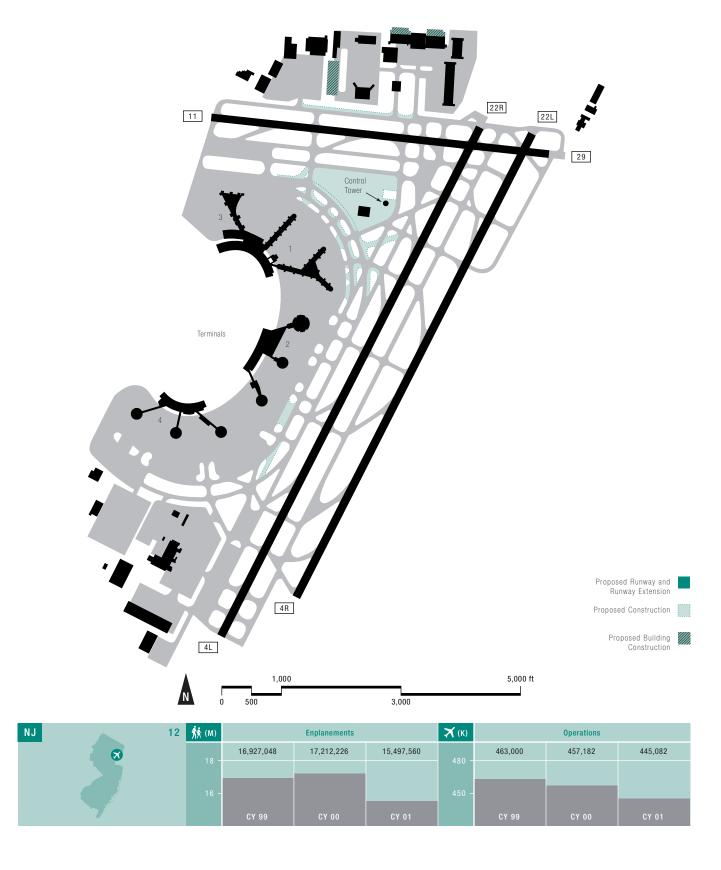
## ELP – El Paso International Airport

Passenger Facility Charge collection was completed for the 1,000-ft. extension of Runway 22. The estimated cost is \$7 million.



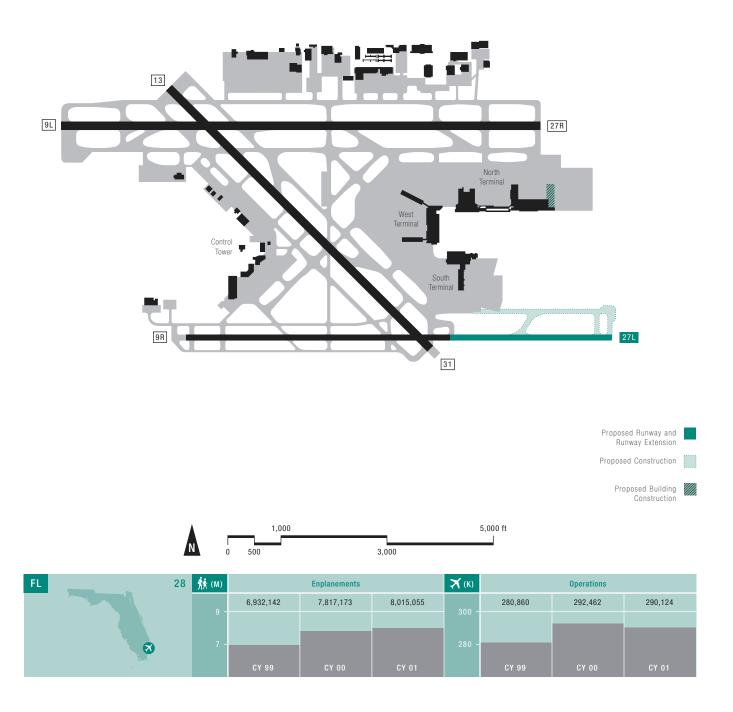
## EWR - Newark Liberty International Airport

A 2,800 foot extension to Runway 4L/22R (4L extension of 1,000 feet, 22R extension of 1,800 feet) has recently been completed.



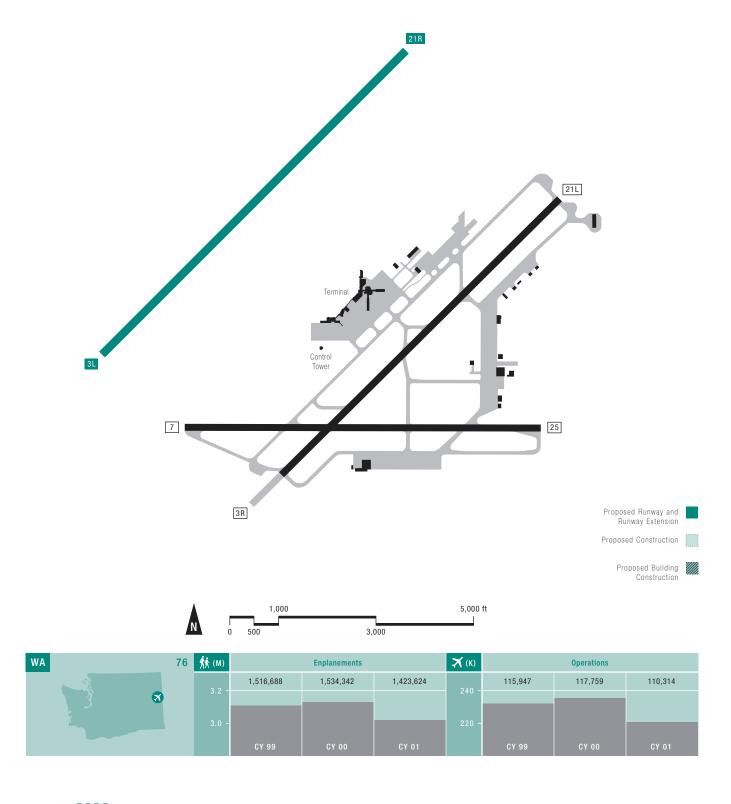
## FLL – Fort Lauderdale-Hollywood International Airport

An extension of the short parallel Runway 9R/27L to 9,000 ft. is planned to provide the airport with a second parallel, air carrier runway. Construction is expected to begin in 2003. The estimated cost of construction is \$300 million. The anticipated operational date is 2005. The extended runway would be used for arrivals and departures and would allow dual dependent IFR arrivals of all types of aircraft.



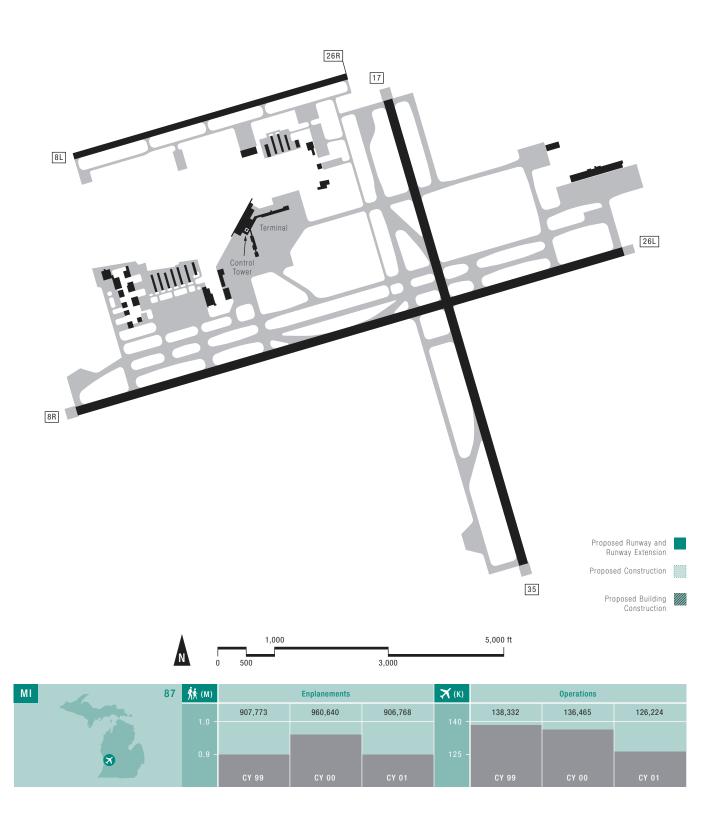
## GEG - Spokane International Airport

The long-term future plan is to construct a new parallel Runway 3L/21R, 8,800 ft. long and separated from Runway 3R/21L by 4,400 ft. This would enable independent parallel operations, doubling hourly IFR arrival capacity.



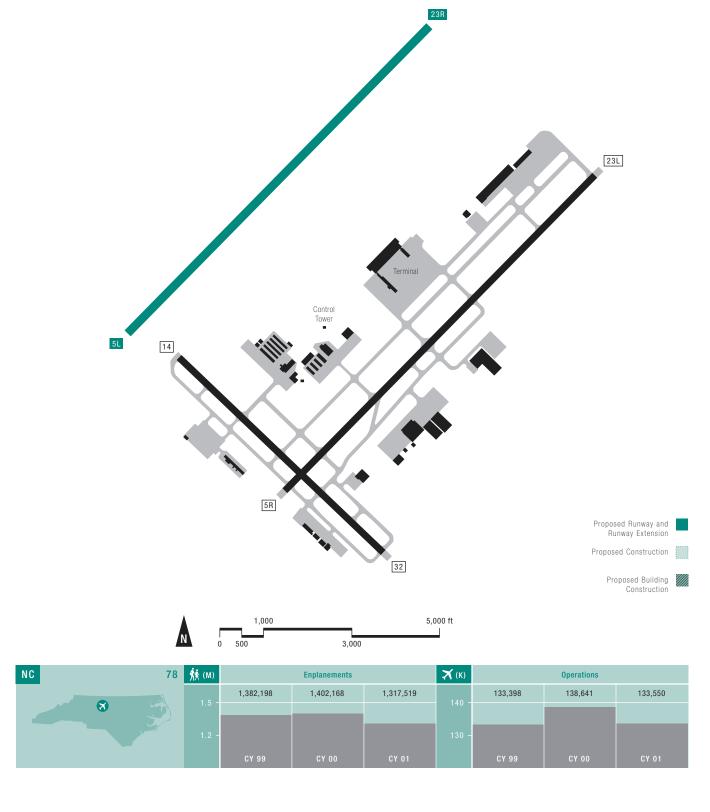
## GRR - Gerald R. Ford International Airport

A new 7,000-ft. parallel Runway 8L/26R is planned for future development. The current 8L/26R would be converted into a taxiway at that time. There are no immediate plans to construct Runway 8L/26R. This is a long-term proposal in 10-20 years.



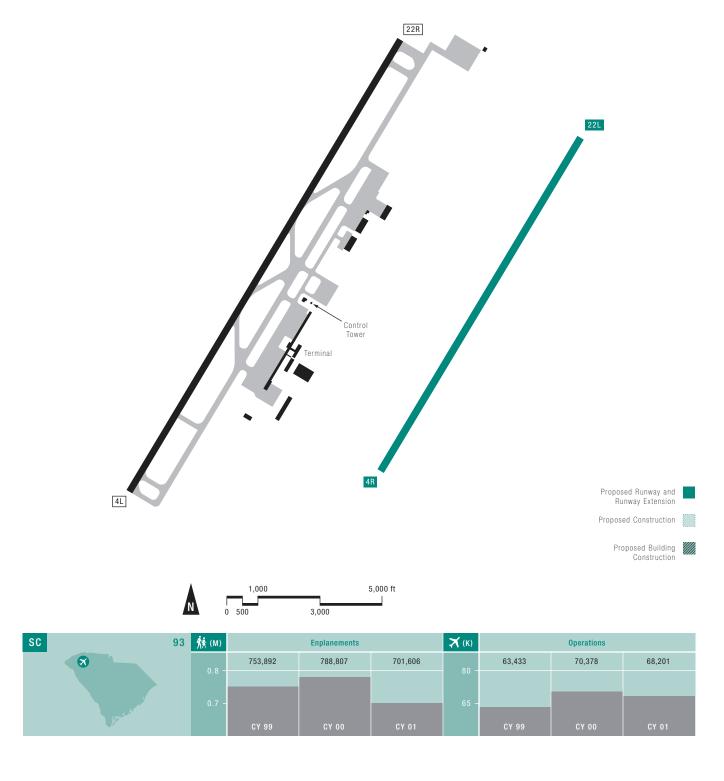
## GSO - Greensboro Piedmont Triad International Airport

Construction of a new 10,000 ft. parallel Runway 5L/23R, 5,300 ft. north of Runway 5/23, is being planned. An EIS was completed in 2001. It is expected to be operational by 2004. The estimated cost is \$96 million. The new runway would allow dual independent arrivals and departures in all weather conditions.



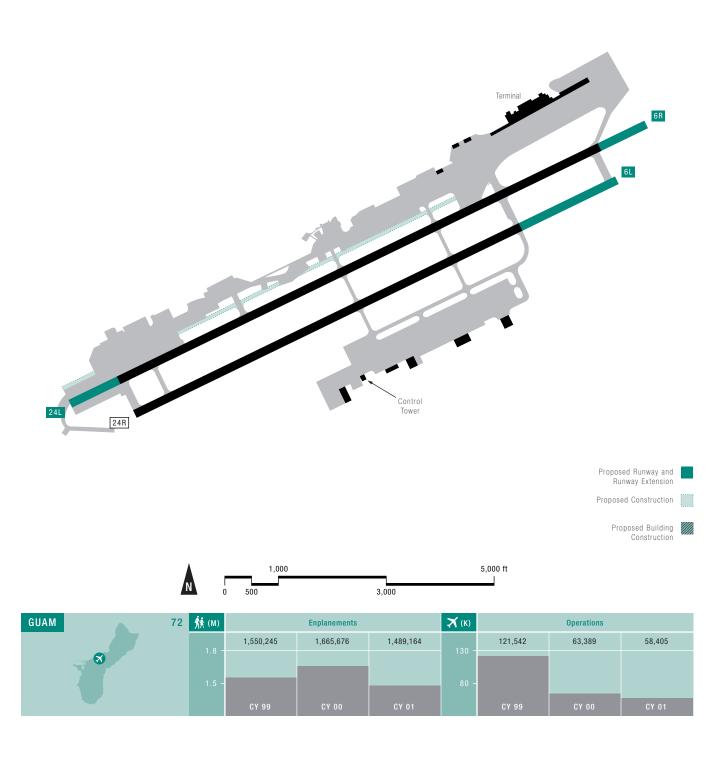
#### GSP - Greenville-Spartanburg International

A new 8,200-ft. parallel Runway 3R/21L is anticipated in 2010 at an estimated cost of \$65 million. Presently, it is planned to have a 4,300-ft. separation from Runway 3L/21R. This would allow dual independent IFR arrivals, potentially doubling hourly IFR arrival capacity. Also, an extension of Runway 3L/21R to 11,000 ft. was completed in 1999 at a cost of \$57.6 million. The extension allows departures of aircraft with larger payloads and/or greater haul-lengths.

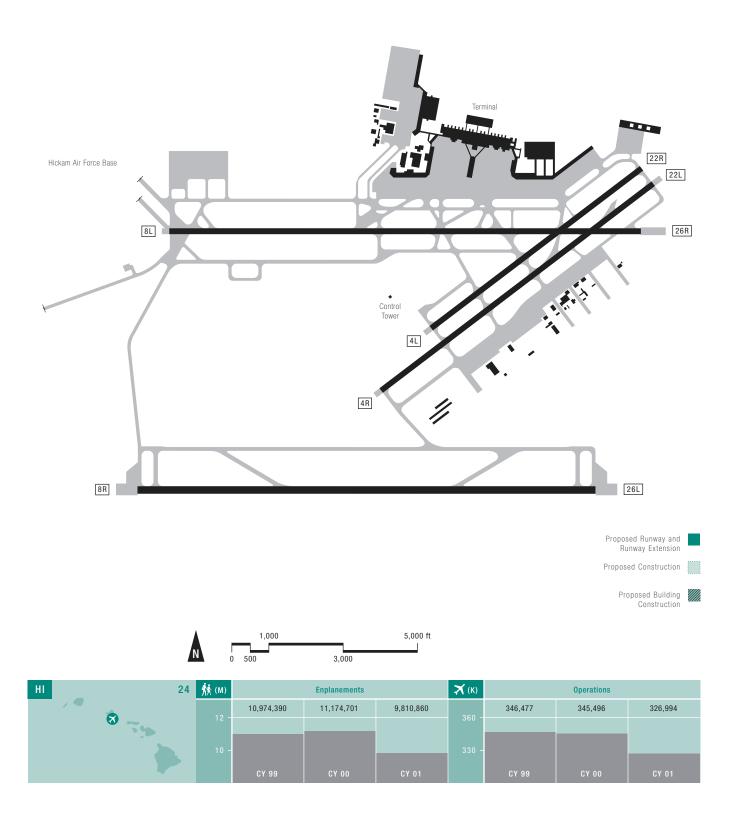


## **GUM** – Guam International Airport

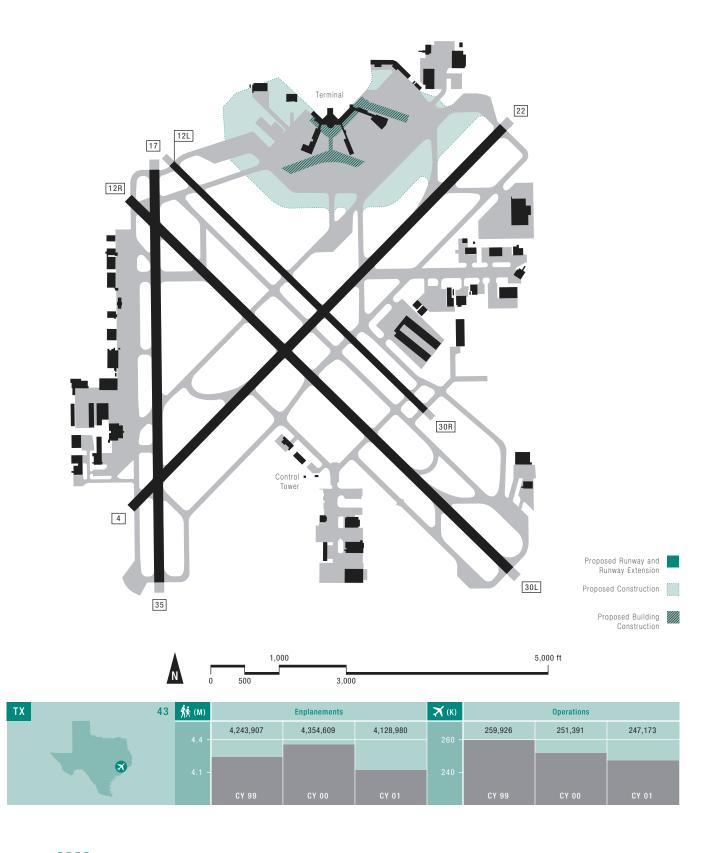
Extensions to both Runway 6L/24R and Runway 6R/24L are proposed. The 2,000 ft. extension to Runway 6L/24R has a proposed operational date of 2004. The 3,000 ft. extension to Runway 6R/24L has a proposed operational date of 2010. Both runway extensions are expected to cost \$30 million each.



## HNL - Honolulu International Airport

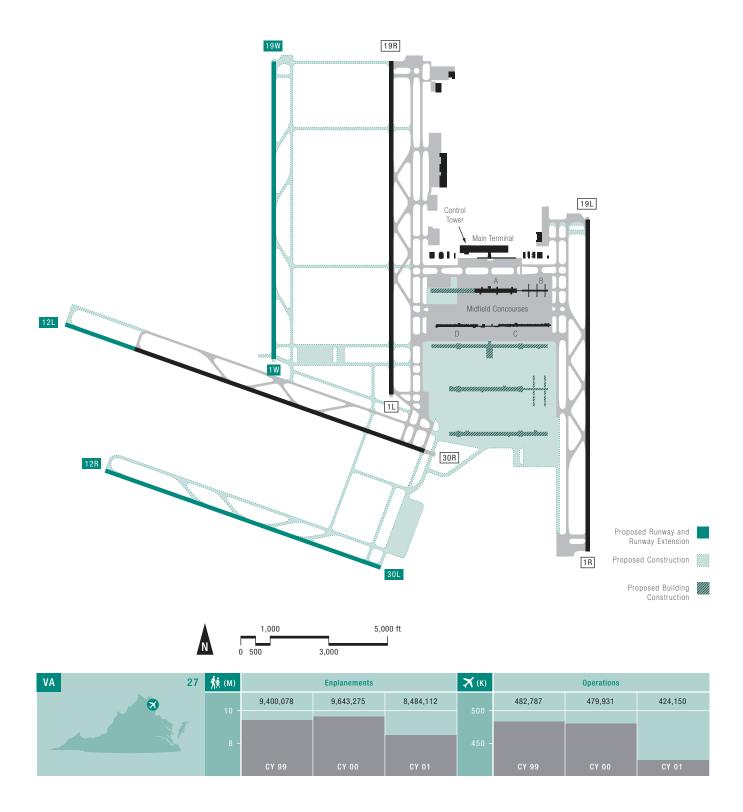


## HOU - Houston William P. Hobby Airport



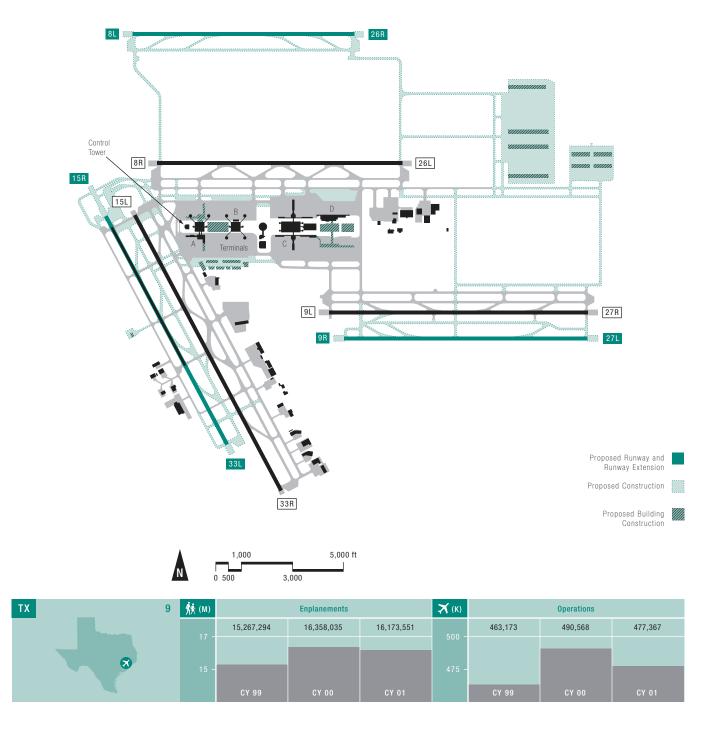
#### IAD - Washington Dulles International Airport

Two new parallel runways are under consideration. A north-south parallel Runway 1W/19W, would be located west of the existing parallels and north of Runway 12/30. This could provide triple independent parallel approaches, if they are approved. A second parallel Runway 12R/30L has been proposed for location southwest of Runway 12/30. The cost to build the two runways is estimated at \$400 million.



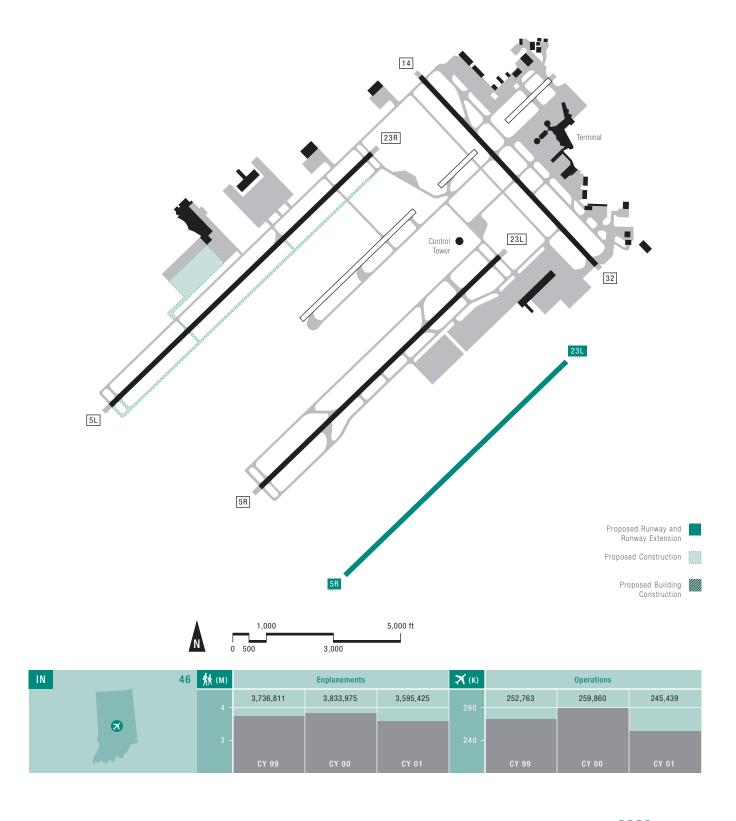
#### IAH - George Bush International Airport

An \$85 million, 4,000-ft. extension to Runway 15R/33L is planned for the year 2002. A new Runway 8L/26R is planned to be parallel to, and north of, the existing Runway 8/26. Commissioning is tentatively scheduled for the year 2003. Runway 8L/26R, in conjunction with Runways 9L/27R and 8R/26L, has the potential to support triple IFR approaches, if approved. Another new runway, 9R/27L, parallel to and south of Runway 9/27, is also planned in the distant future. Construction is expected to cost \$260 million for Runway 8L/26R.

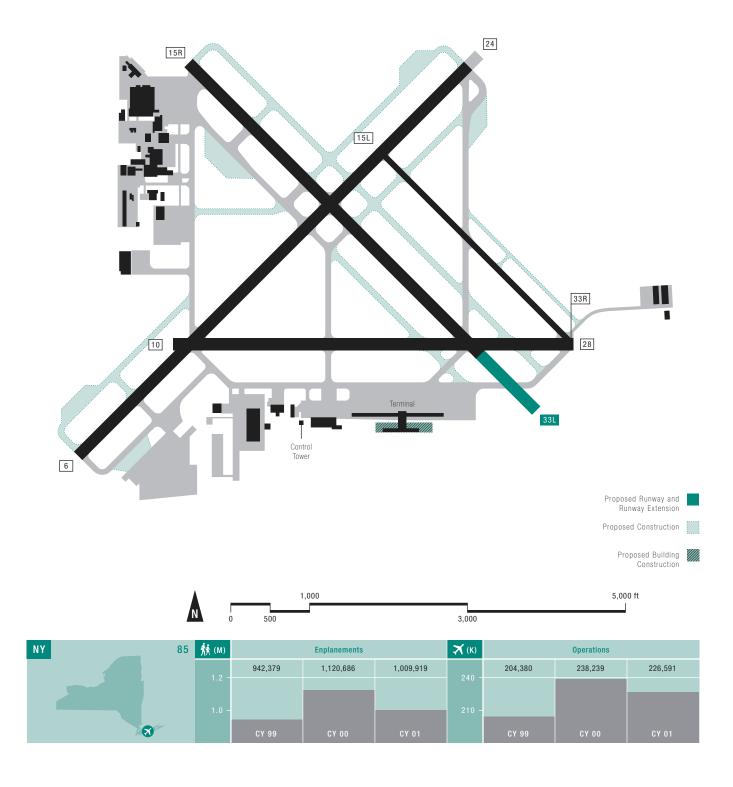


## IND - Indianapolis International Airport

A third parallel Runway 5R/23L, is planned south of existing Runway 5R/23L (to be renamed 5C/23C). Estimated project cost is \$80 million, and the expected operational date is 2008. Taxiway "N" was put into service in October 1999 at a total cost of \$7.6 million.

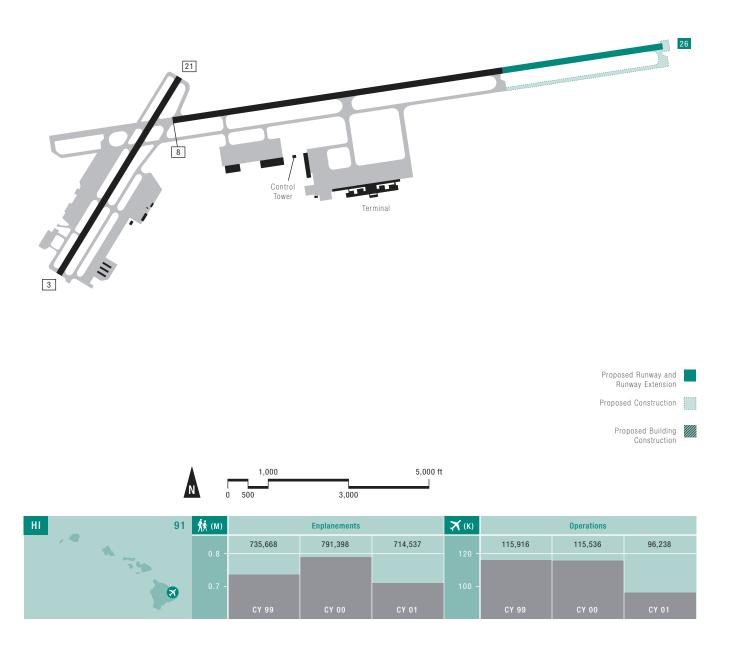


# ISP - Islip Long Island MacArthur Airport

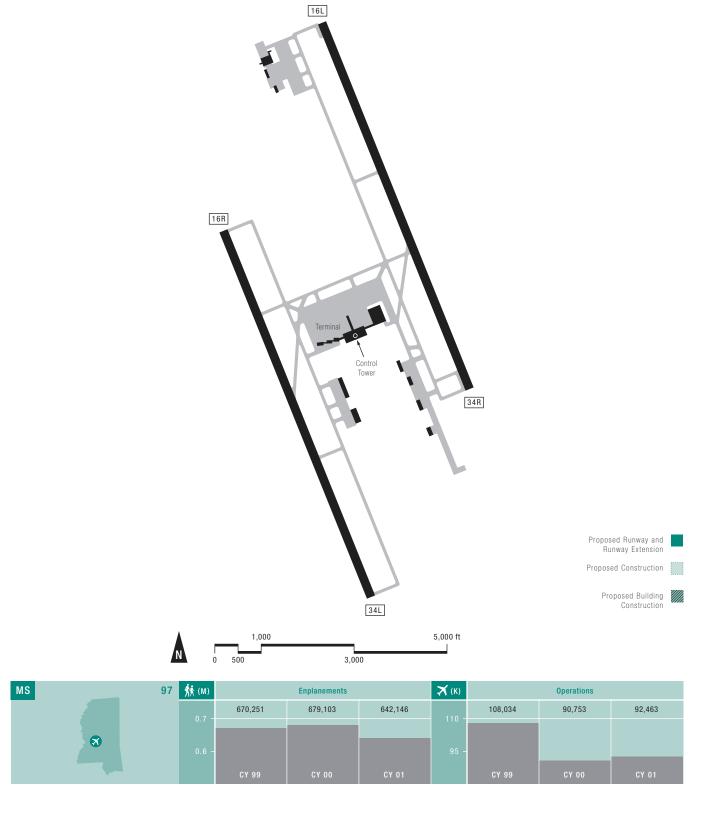


## ITO - Hilo International Airport

A 2,200 ft. east extension of Runway 8/26 is proposed for development by between 2011 and 2020.

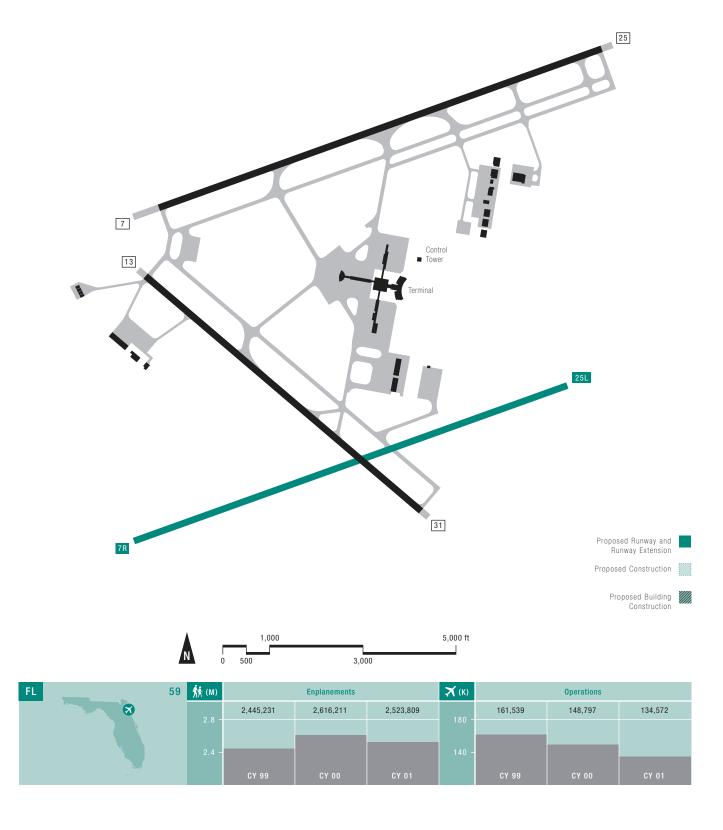


## JAN - Jackson International Airport



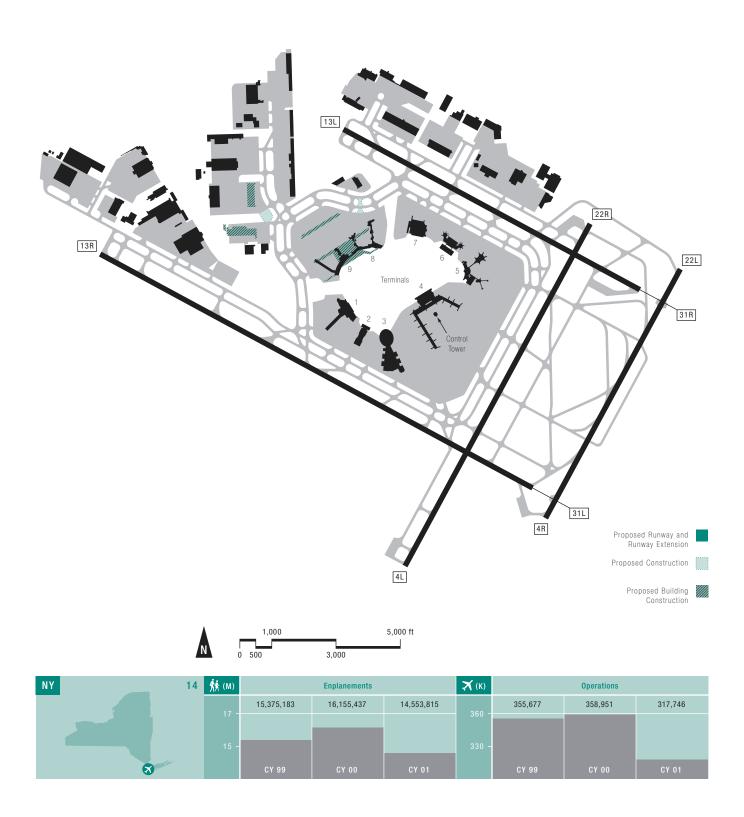
## JAX – Jacksonville International Airport

A new parallel Runway 7R/25L is being planned. It will be 6,500 ft. south of the existing Runway 7/25, permitting independent parallel IFR operations and potentially doubling Jacksonville's hourly IFR arrival capacity. Construction is scheduled to begin in 2010, with completion expected in 2011. The estimated cost of construction is \$50 million.

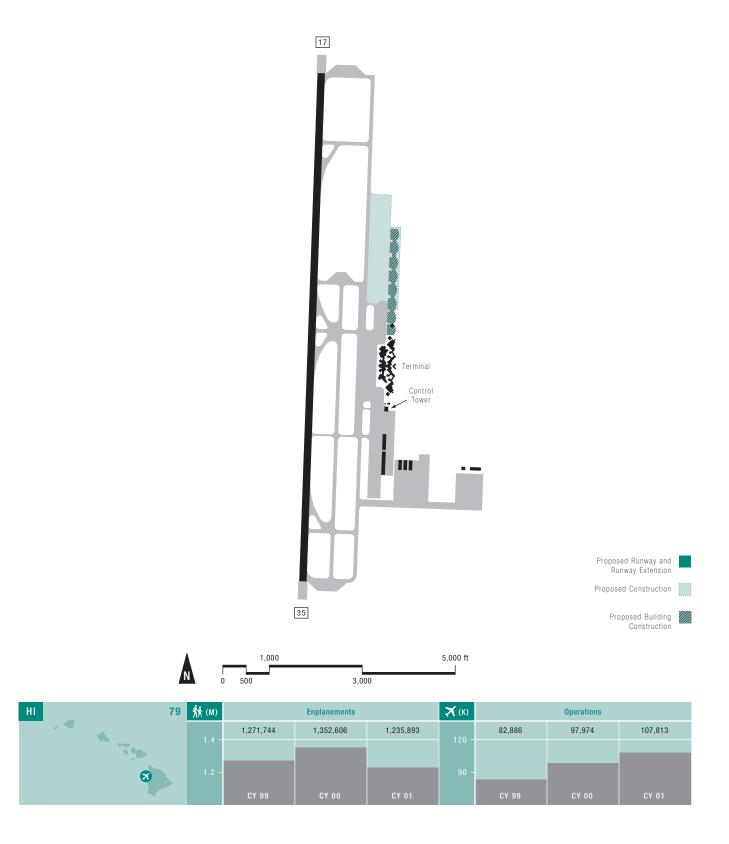


## JFK - New York John F. Kennedy International Airport

Construction to widen runway 4R/22L from 150 ft. to 200 ft. was completed in early November 2002. Reconstruction plans for Runway 13R/31L will start and be completed in 2005. No estimates of cost are available at this time.

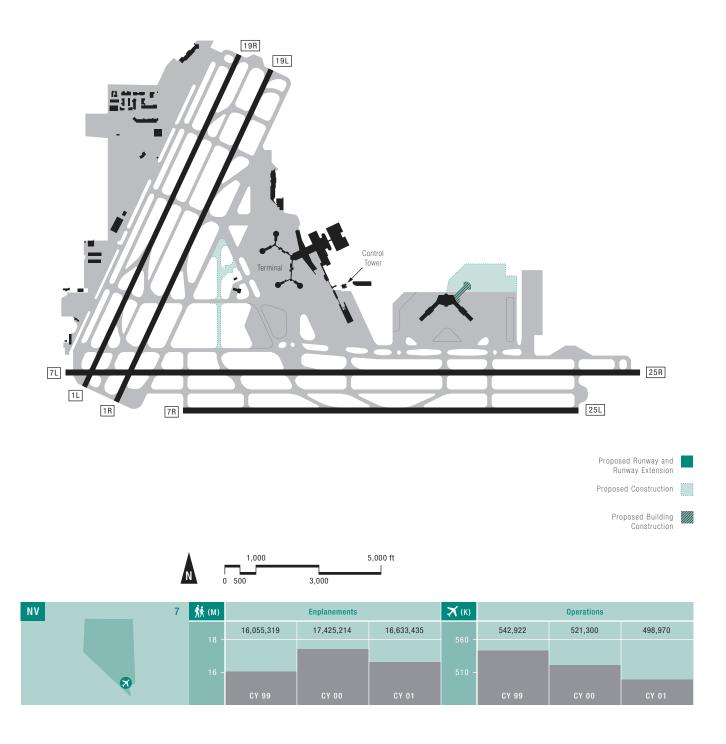


## KOA – Kona International Airport at Keahole



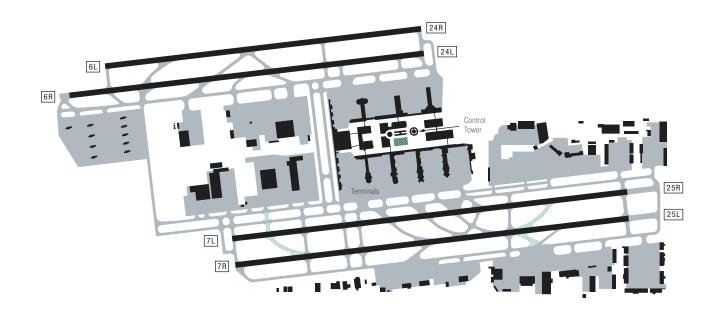
#### LAS - Las Vegas McCarran International Airport

Construction plans are underway to construct 3,000 feet of taxiway north of taxiway B, with connections to taxiways G and D. This project is estimated to cost \$23.3 million. Plans for terminal development include construction of an apron and taxi lane to support a 12-gate expansion of the D concourse. The apron and taxi lane work is estimated to cost \$20 million, and construction of the terminal building, estimated to cost \$80 million, may not commence until after December 31, 2002.

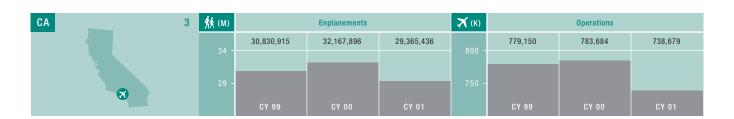


# LAX – Los Angeles International Airport

Taxiway exits and a new parking structure are planned at this airport.

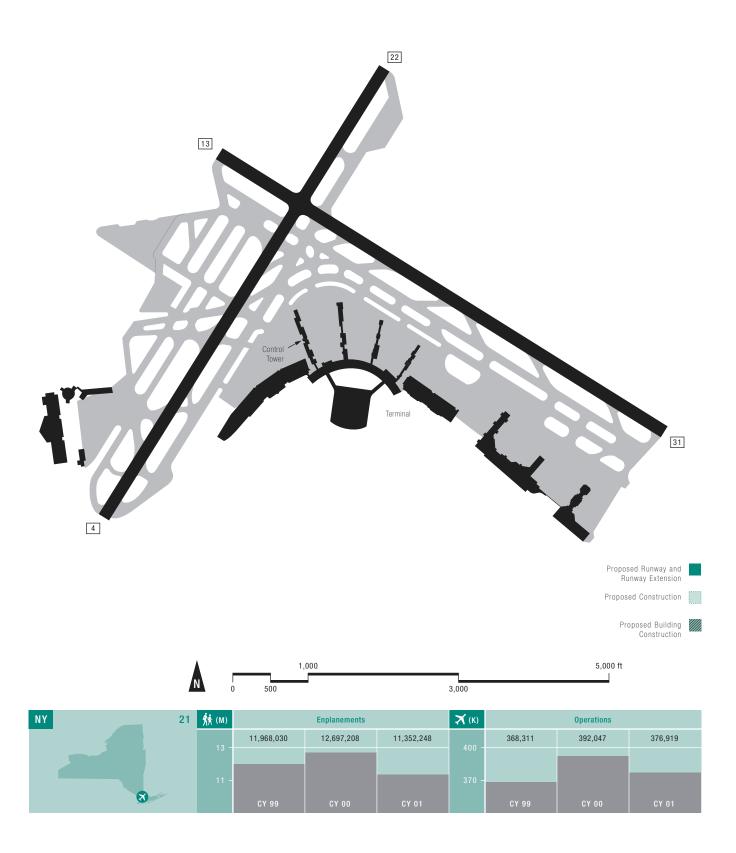




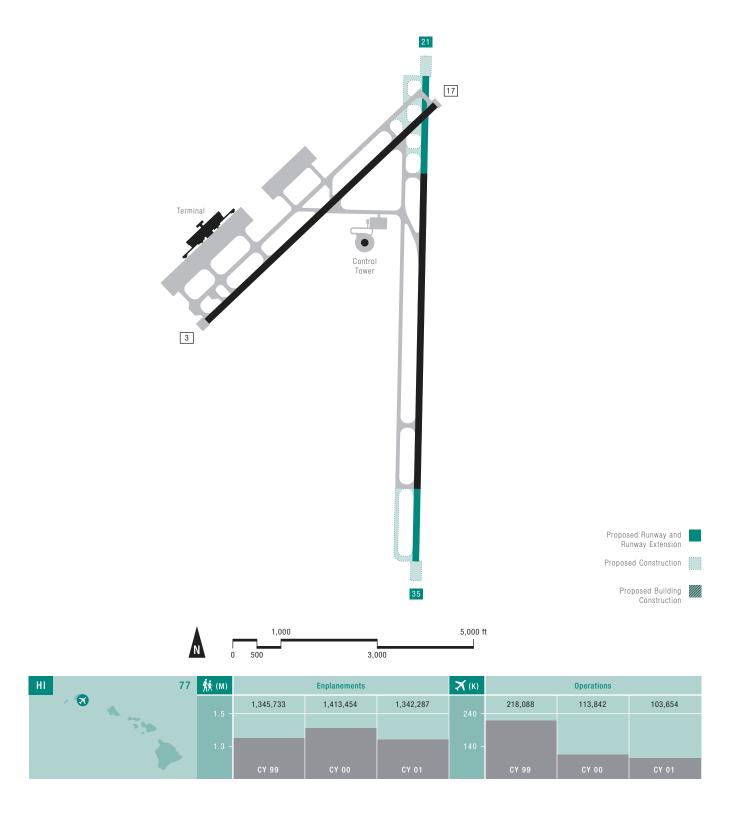


3,000

## LGA - New York LaGuardia Airport

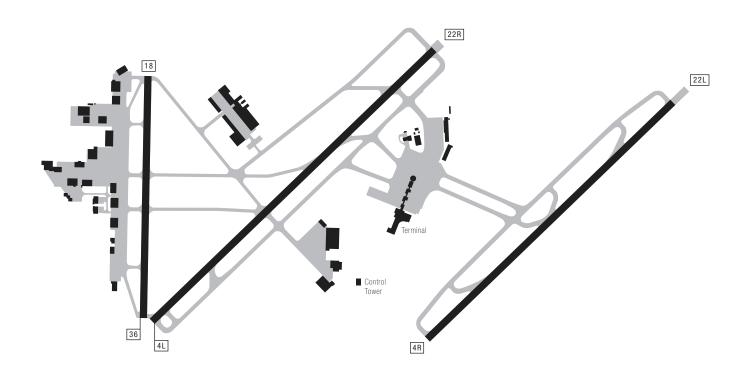


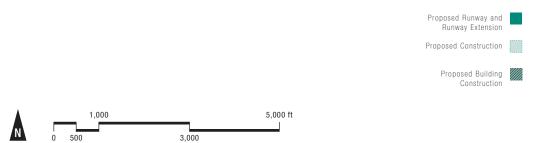
## LIH – Lihue Airport



## LIT - Little Rock Adams Field

An extension of Runway 4L/22R was completed in late 1998.

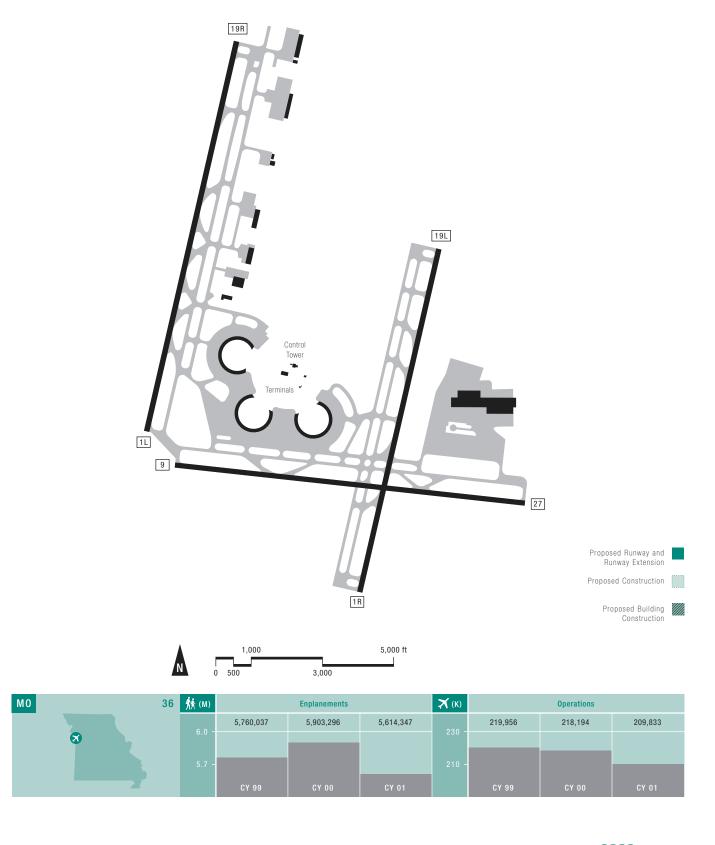




AR	80 <b>½</b> (M)		Enplanements			<b>≯</b> (K)	Operations		
		1.4 -	1,292,507	1,276,145	1,211,753	190 -	181,958	174,802	176,067
		1.4							
		1.2 -				160 -			
			CY 99	CY 00	CY 01		CY 99	CY 00	CY 01

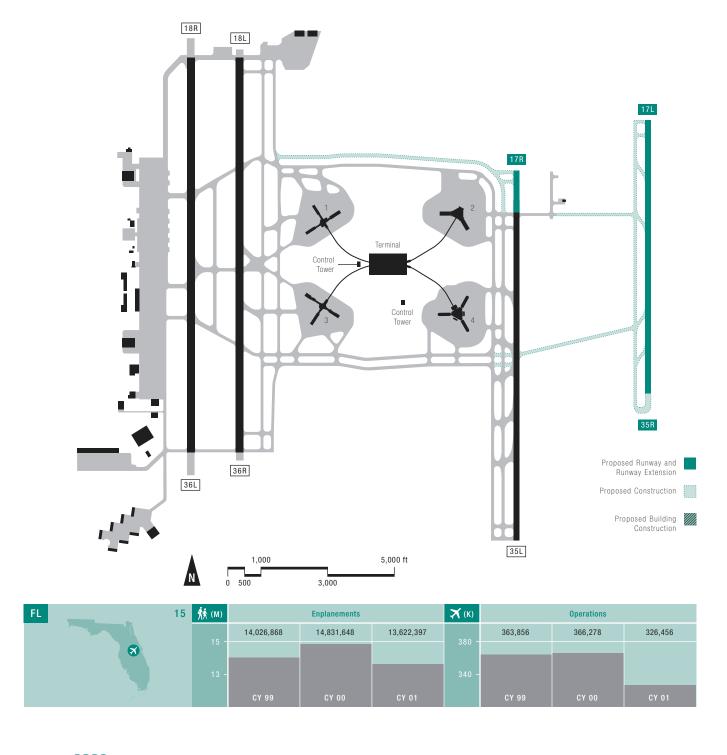
## MCI - Kansas City International Airport

In accordance with the Airport Master Plan, an extension of Runway 1L/19R is currently planned for the future. One additional parallel runway west of the existing north-south runway is being considered after 2020.



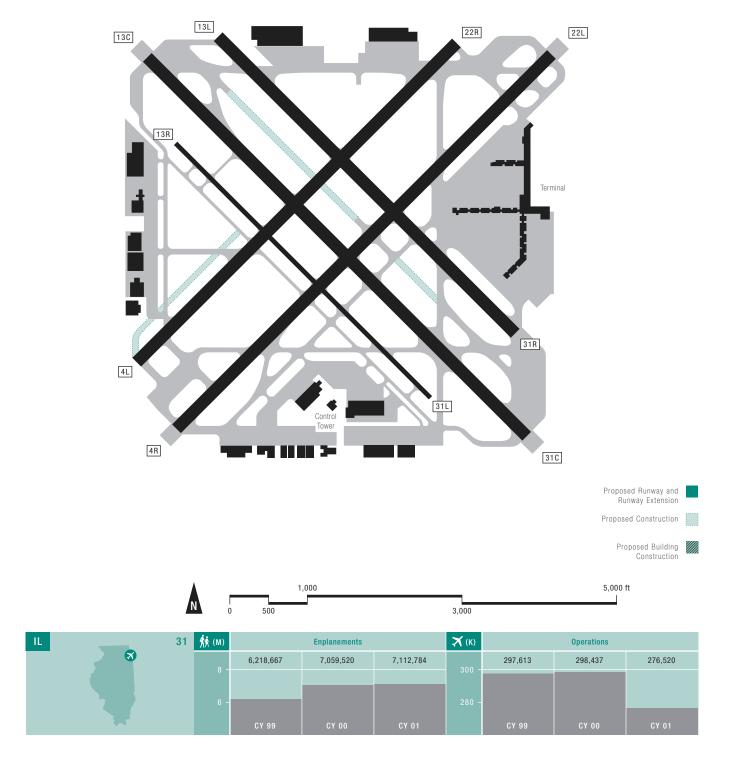
#### MCO - Orlando International Airport

A new 9,000 ft. fourth parallel Runway 17L/35R that will allow simultaneous triple flow instrument approaches will be open for operations in 2003. The cost of the runway is \$203 million. It will be located 4,300 ft. east of existing Runway 17R/35L which has a 1,000-ft. extension planned to prevent aircraft from obstructing the Runway 17R approach. A new Air Traffic Control Tower is under construction and will be one of the tallest towers in the USA. A new north cross-field taxiway has been completed and is now operational. A fourth airside passenger terminal located in the North Terminal area has been completed and is now open. The first phase of a new South Terminal is now in the design stage and will open in 2005.



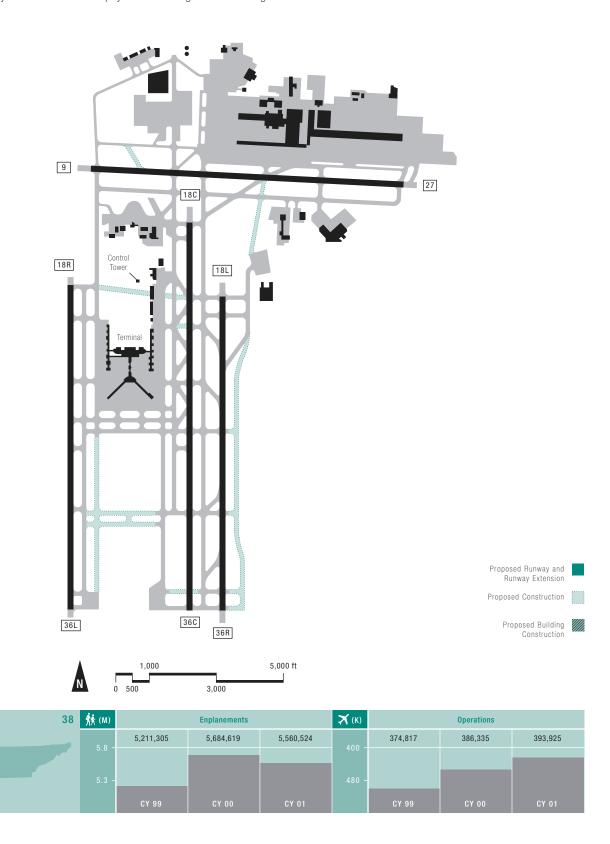
## MDW - Chicago Midway Airport

There are no new runway or runway extension projects planned, proposed, or currently under construction at this airport.



#### MEM - Memphis International Airport

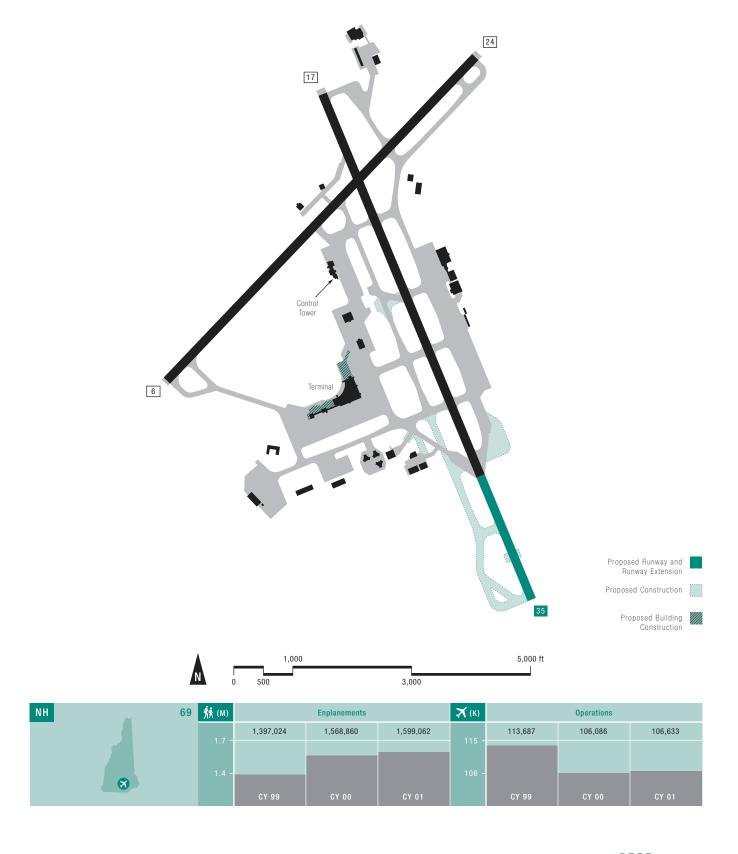
A reconstruction and extension of Runway 18C/36C was recently completed at an estimated cost of \$103 million. The extended runway will allow departures by aircraft with heavier payloads and/or greater haul-lengths.



8

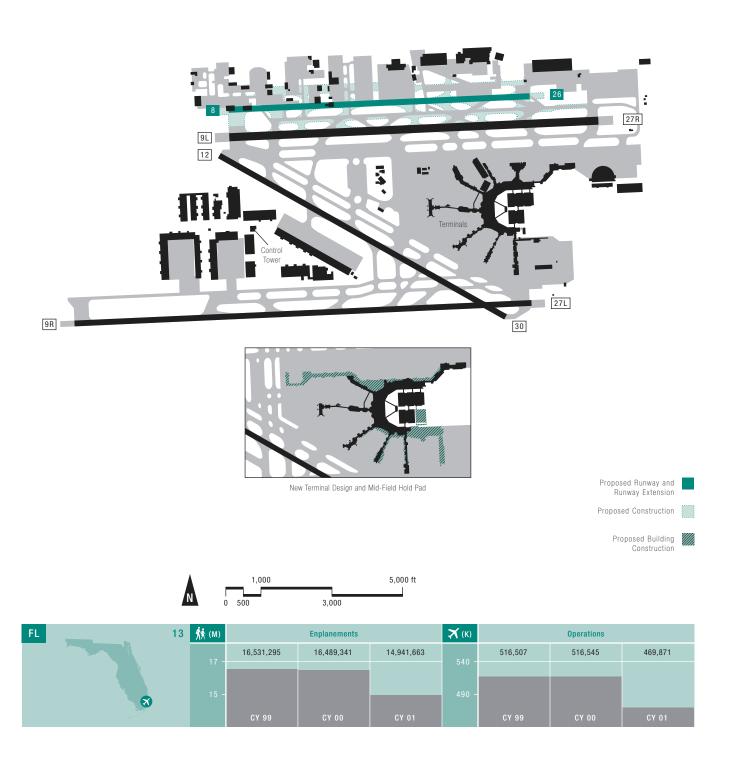
### MHT - Manchester Airport

Current plans call for the reconstruction and extension of Runway 17/35 that includes a 2,250 extension of Runway 35 to the South. Taxiway "A" will also be extended.



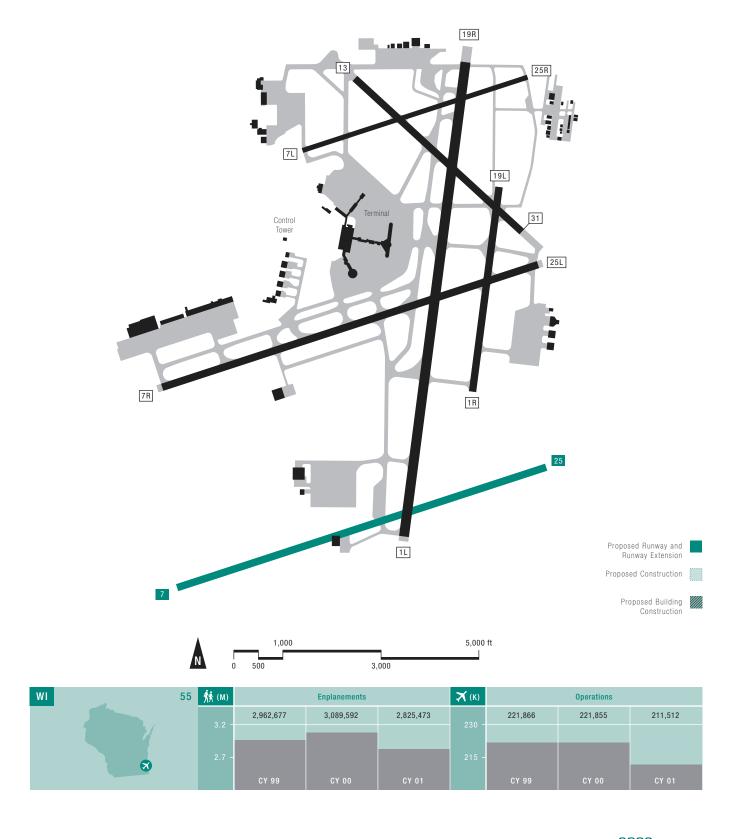
#### MIA - Miami International Airport

Construction of a new air carrier Runway 8/26, 8,600 ft. long and 800 ft. north of existing Runway 9L/27R, is estimated to be completed by 2003. The estimated cost of construction is \$206 million. An EIS was completed in December 1998. The new Runway is planned for use primarily as an arrival runway in VFR and non-precision IFR conditions.



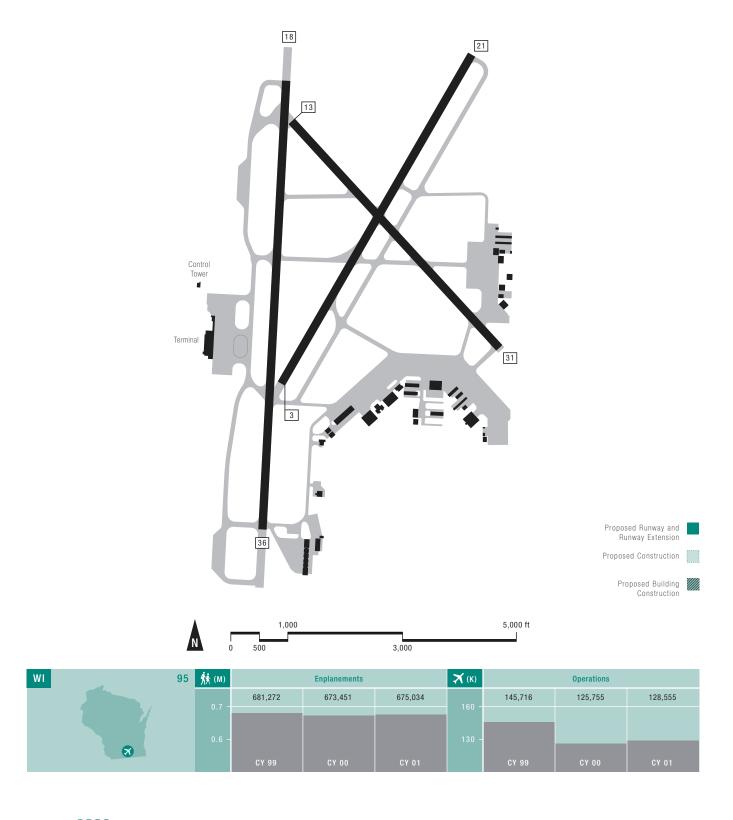
### MKE - Milwaukee General Mitchell International Airport

A 700-ft. extension to Runway 7L/25R was completed in the summer of 1998. Extension of this runway from 4,100 ft. to 4,800 ft. will accommodate commuter aircraft and delay the need for a third parallel runway until about the year 2015.



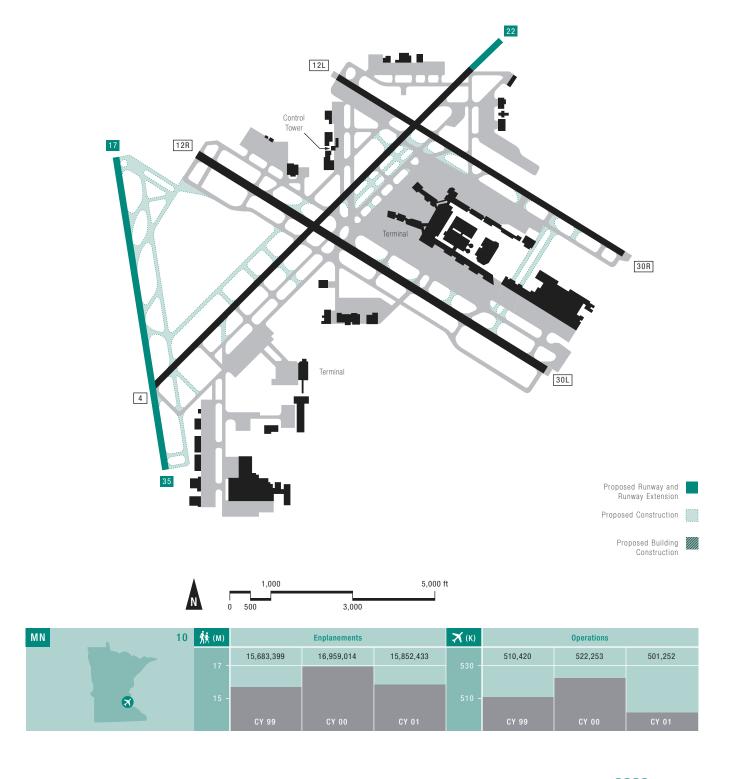
#### MSN - Madison/Dane County Regional Airport

The airport is currently undertaking an Environmental Assessment (EA) for the Runway Safety Area of the Runway 13/Runway 18 Approaches. Presently Runway 13 does not meet FAA Runway Safety Area design criteria due to railway, waterway, and perimeter road intrusions. The actions proposed under the EA will correct design deficiencies of the Runway Safety Area, clear up pavement marking discrepancies on Runway 13, and provide for clear approaches to Runway 13 and 18.



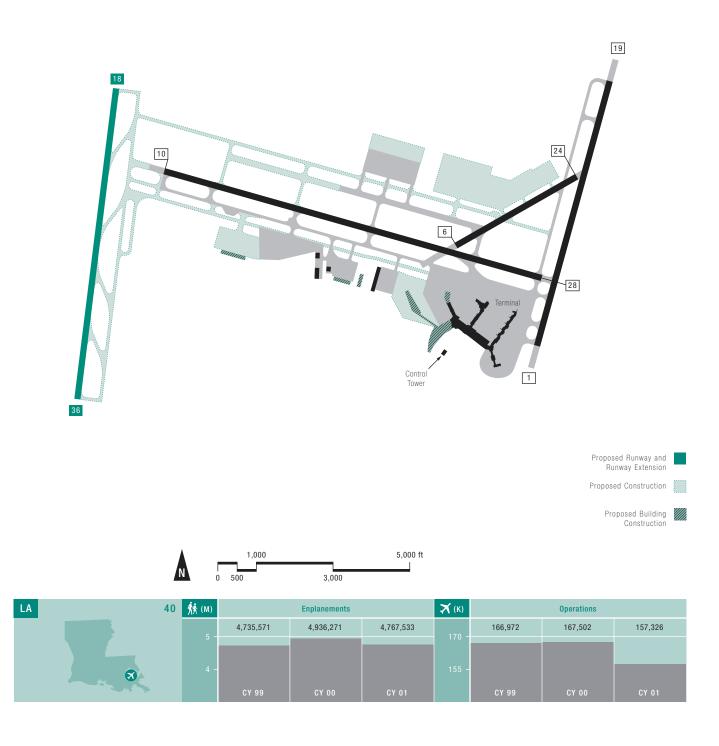
### MSP - Minneapolis-St. Paul International Airport

Construction of the proposed 8,000 ft. Runway 17/35, at a cost of \$490 million, will reduce the projected 2020 annual delay cost from \$66 million to \$38 million. The runway is expected to be operational in 2004 and will be used primarily for departures to the south and arrivals from the north. Construction of a 1,000 ft. extension to the northeast end of Runway 4/22 is planned.



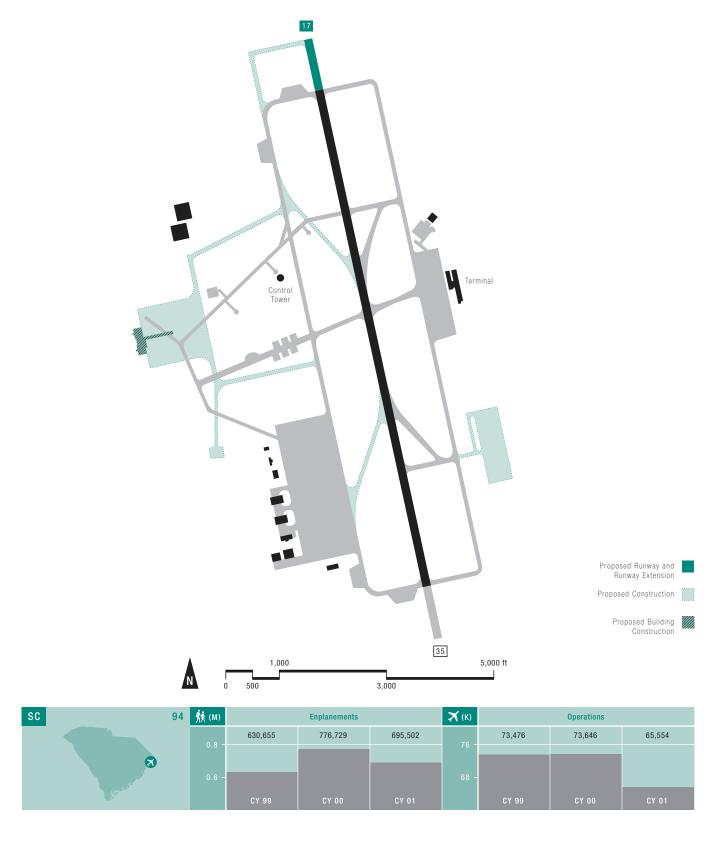
### MSY - Louis Armstrong New Orleans International Airport

A new north-south Runway 18/36, is planned. This new runway will be nearly parallel to the existing Runway 1/19 and will be located west of the threshold of Runway 10, approximately 11,000 ft. away from Runway 1/19. Pending environmental findings and funding availability, it is expected that the runway will be completed around 2010.



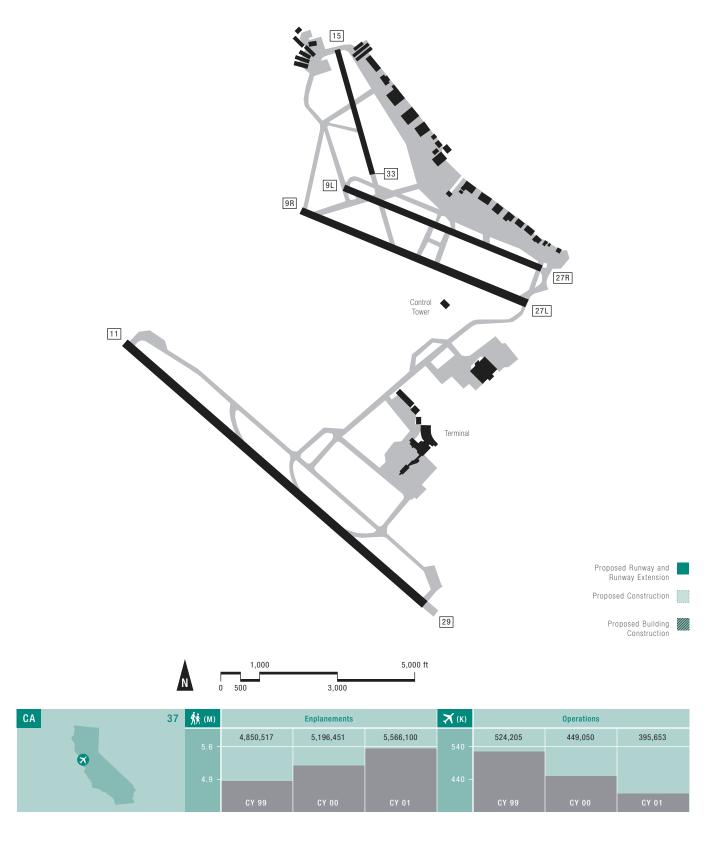
### MYR - Myrtle Beach International Airport

A recent Master Plan update recommends that the airport should develop a new terminal by the year 2005, extend the 9,500 ft. runway by 1,000 ft. to the north, and begin plans for a parallel runway. In the near future, Runway 17/35 will be redesigned as Runway 18/36.



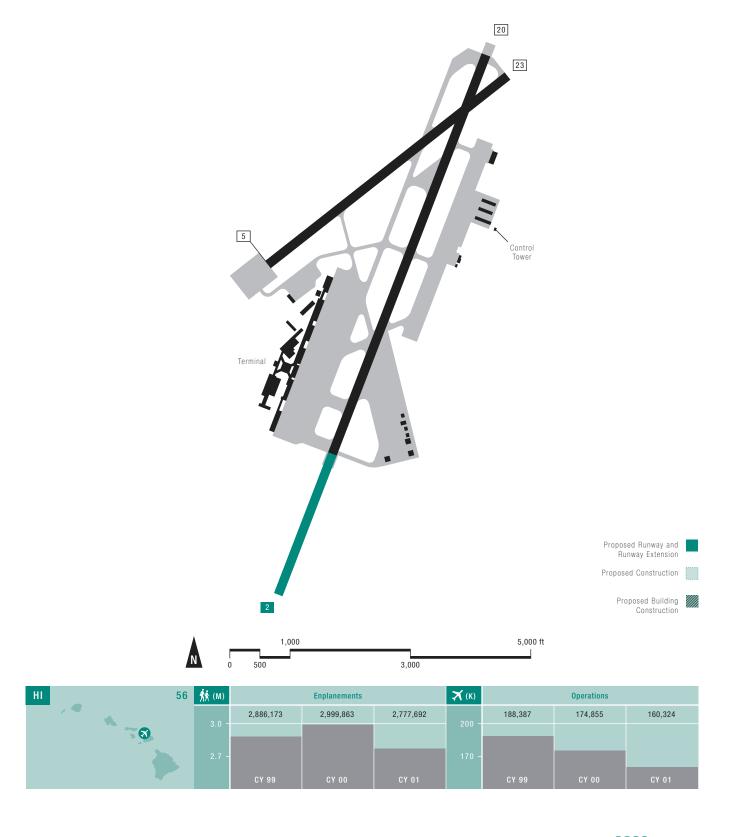
### **OAK - Metropolitan Oakland International Airport**

There are no new runway or runway extension projects planned, proposed, or currently under construction at this airport.



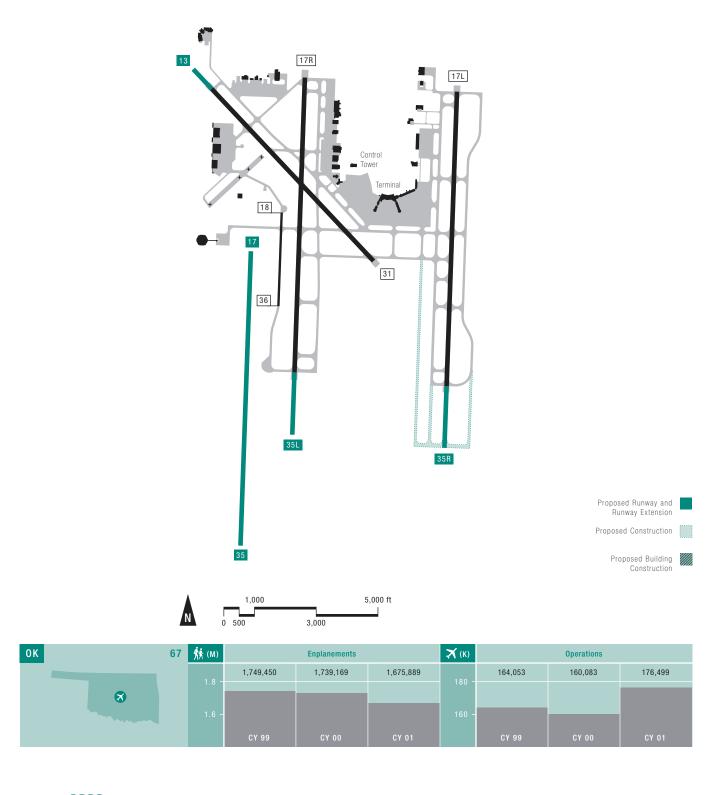
### OGG - Kahului Airport

There are no new runway or runway extension projects proposed, or currently under construction at this airport.



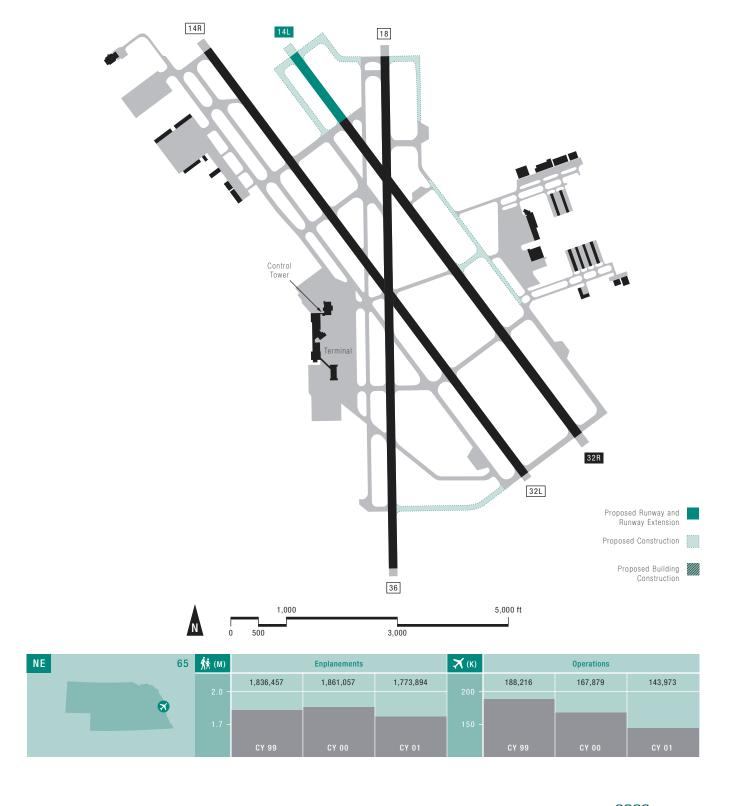
#### OKC - Oklahoma City Will Rogers World Airport

Construction of a new west parallel runway 1,600 ft. west of Runway 17/35 is reflected on the ALP. Estimated cost of construction is \$13 million. Extensions to both north/south runways, Runways 17L/35R and 17R/35L, are also planned. The estimated cost of extending the runways is \$8 million each. Construction of the extension to Runway 17R/35L is expected to start in 2010 and be completed by 2014. A 2,200 ft. extension to the northwest of Runway 13/31 is planned as well. Relocation of MacArthur Boulevard may begin in 2003, with runway completion in 2010. The cost is estimated at \$11.6 million.



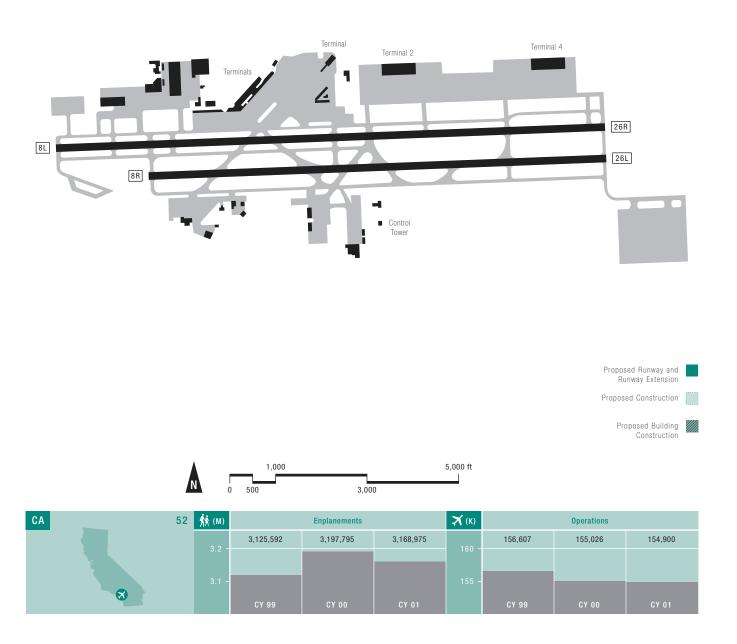
### OMA - Omaha Eppley Airfield

An extension of Runway 14L/32R to 7,000 ft. is planned, and the project was approved via an LOI of \$44 million. The extension of Runway End 14L has not been funded, however, construction is planned for 2003 or 2004. Plans beyond 2007 include reconstruction of Runway 14R/32L, at an estimated cost of \$24.5 million, and the reconstruction of Runway 18/36 is estimated to cost \$8.5 million.



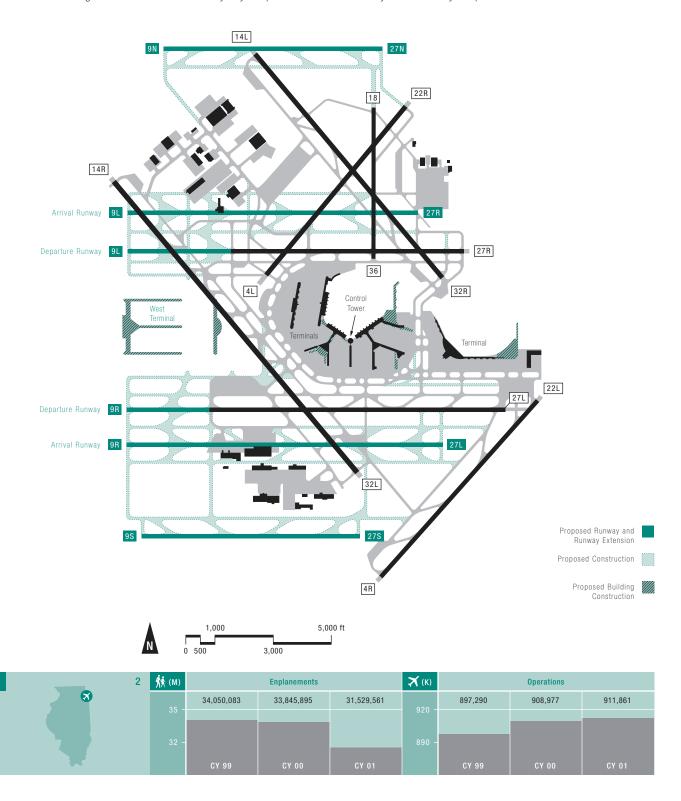
### ONT - Ontario International Airport

Plans are proposed for a runway reconstruction that will be operational in 2005, at an estimated cost of \$34.2 million.



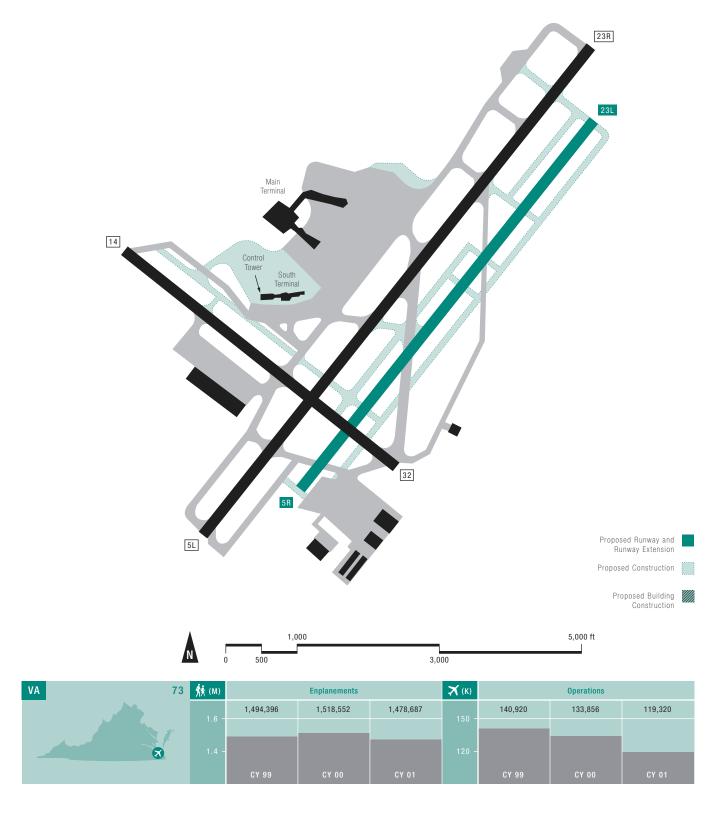
#### ORD - Chicago O'Hare International Airport

The O'Hare Modernization Plan currently consists of constructing one new runway and relocating three of the existing seven runways along with the required new taxiways to provide a new airfield configuration with six runways in the 9/27 direction and two in the 4/22 direction. Airfield construction, estimated at \$2.5 billion, will be phased over several years with the construction of the first new runway beginning in 2004. This new configuration will reduce IFR delays by 95 percent and overall delays at O'Hare by 79 percent.



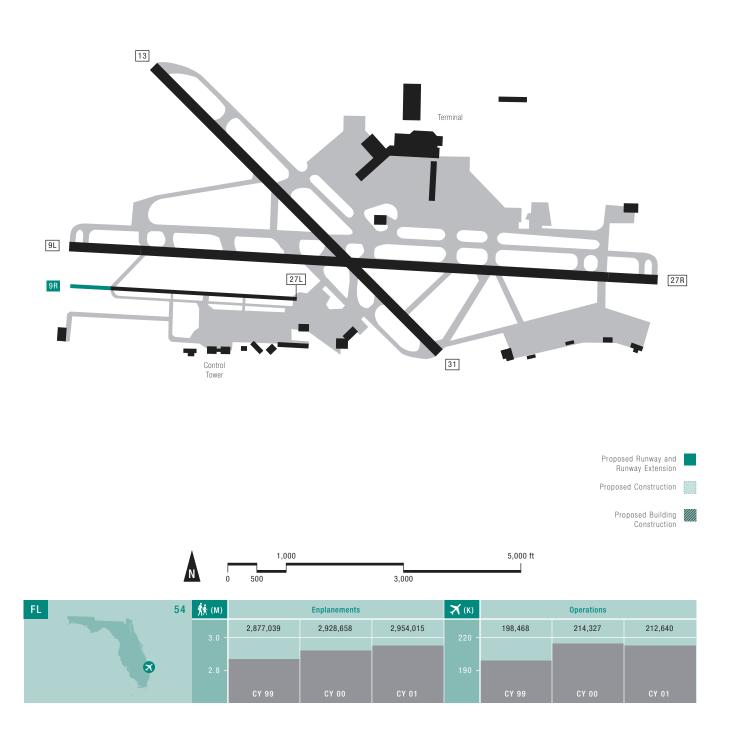
### ORF - Norfolk International Airport

A new air carrier runway, Runway 5R/23L, was analyzed by the Eastern Virginia Capacity Design Team. An Environmental Review is currently underway. Runway construction was scheduled to begin in 2002 with completion by 2004, at an estimated cost of \$100 million providing the airport can acquire the small amount of additional land required.



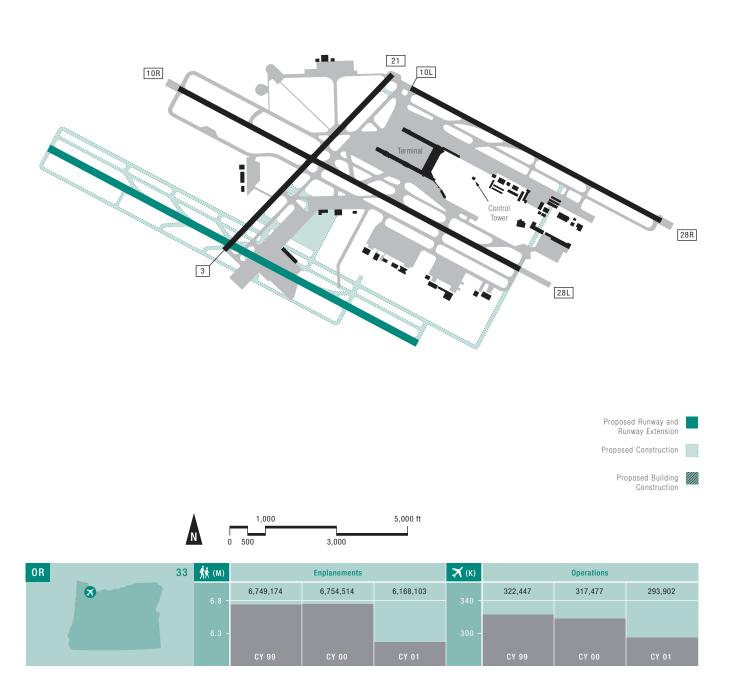
#### PBI - Palm Beach International Airport

Runway 9L/27R is planned to be extended 1,200 ft. to the west and 811 ft. to the east, for a total length of 10,000 ft. The total estimated project cost is \$9 million. An Environmental Assessment was completed and a Finding of No Significant Impact (FONSI) was issued in April 1998. Construction was completed in 2000. The runway thresholds will remain in their present locations; therefore, the extended length will only be used for departures.



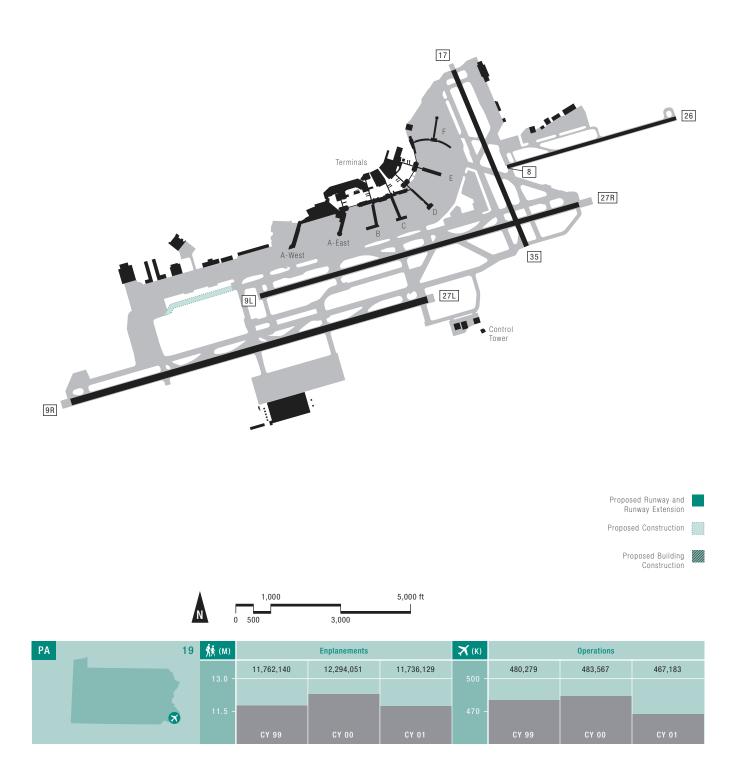
#### PDX - Portland International Airport

An update of the 1996 Capacity Enhancement Plan was completed in an initial phase in 2001, with the final phase to be completed in 2003. The update evaluated development of a third parallel runway south of the existing parallel runways with associated taxiways (not shown) under construction after 2020, and constructing an additional terminal or expanding the existing terminal. The update also evaluated the capacity benefit or impact of the new parallel runway under various operating scenarios. Two new connecting taxiways are proposed over the next 5 years to reduce runway occupancy times on Runway 10R/28L and congestion on the south parallel taxiway.



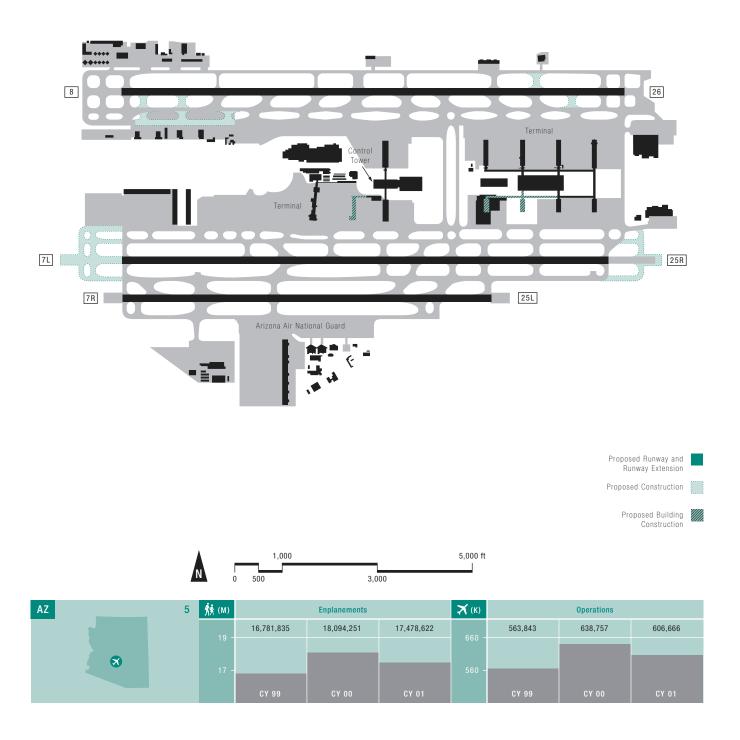
### PHL - Philadelphia International Airport

The new 5,000-ft. parallel commuter runway, Runway 8/26, opened in late-1999 at an estimated cost of \$220 million. It is located 3,000 ft. north of Runway 9R/27L.



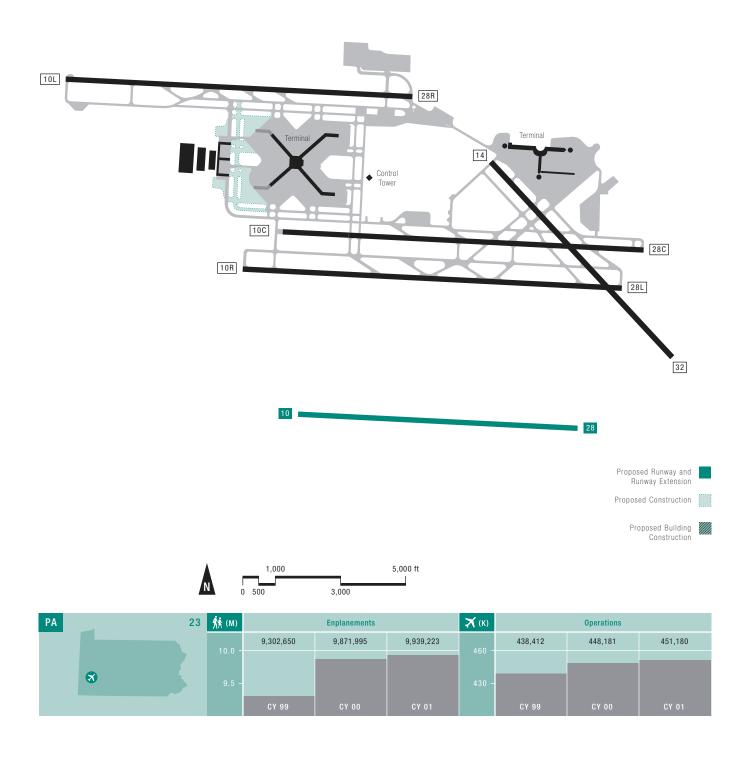
### PHX - Phoenix Sky Harbor International Airport

A new third parallel runway, Runway 7/25 800 ft. south of Runway 8R/26L, was completed in 2000. Runway 7/25 is being constructed to a length of 7,800 ft. The airport layout plan proposes an ultimate length of 9,500 ft., but further construction is not scheduled at this time. The construction of a 900 ft. west extension of Runway 8L/26R, at cost of \$7.0 million, was completed in 2001.



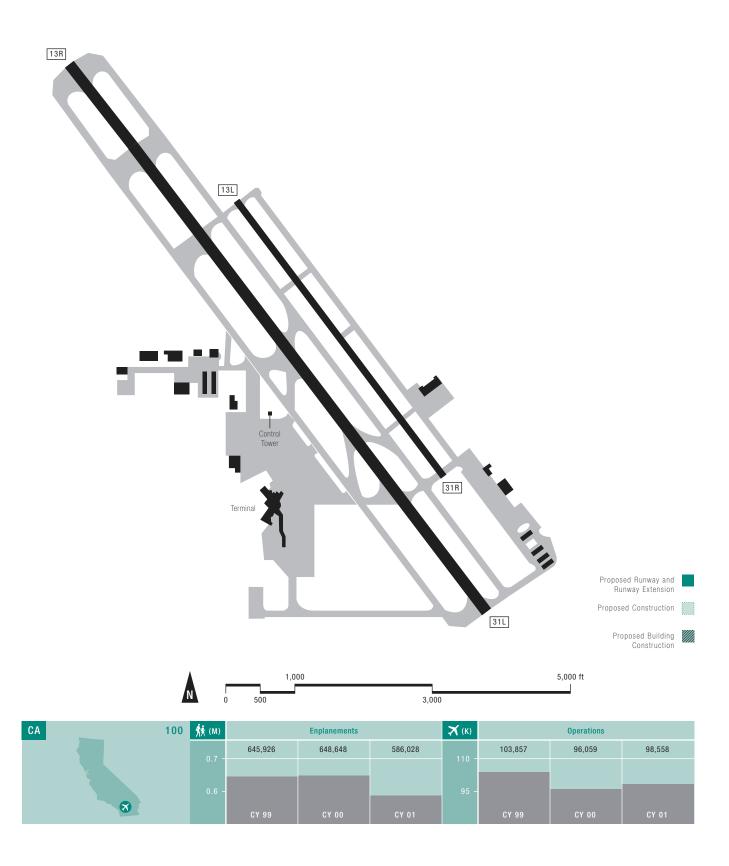
#### PIT - Greater Pittsburgh International Airport

The ongoing Master Plan has recommended that at least two new runways will be needed within a 20-year planning period to accommodate projected Baseline (normal growth) forecast demands and achieve acceptable aircraft delay times and associated delay costs. The southern parallel will be located approximately 4,300 ft. south of existing Runway 10R/28L and should be operational by the time the airport reaches 495,000 annual aircraft operations. The Master Plan was completed in 2001.



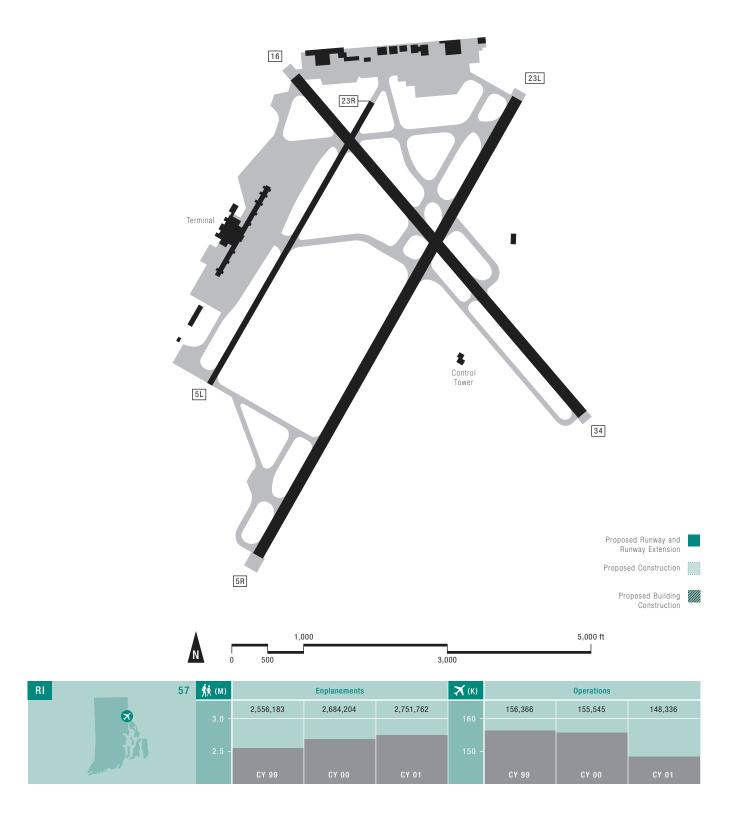
### PSP - Palm Springs Regional Airport

There are no new runway or runway extension projects planned, proposed, or currently under construction at this airport.



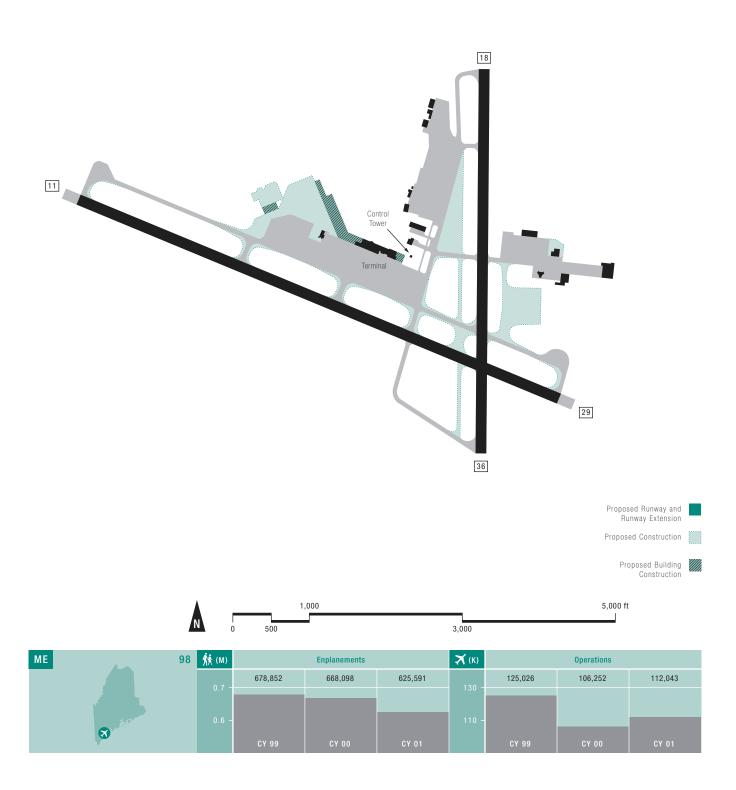
## PVD - T.F. Green Airport

T.F. Green Airport is currently in the process of updating its Airport Master Plan.



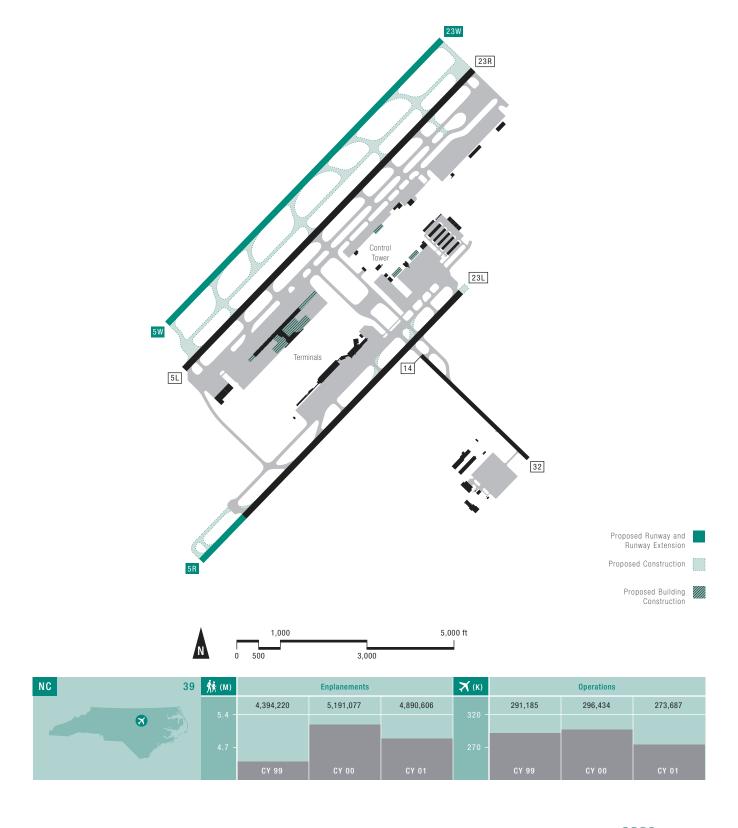
### PWM - Portland International Jetport

The design is completed for a 400 ft. extension to the west end of runway 11/29, an upgrade to CAT III for runway 11/29, and complete rehabilitation of runway 11/29 and associated taxiways. Construction of the 11/29 runway extension will begin in 2002.



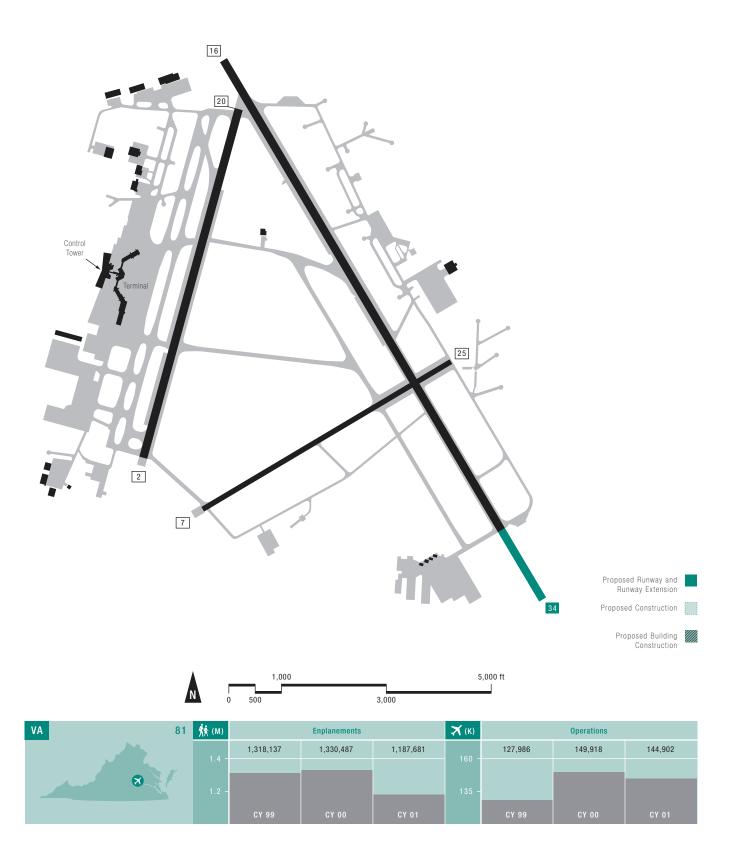
### RDU - Raleigh-Durham International Airport

A new 8,000-ft. parallel Runway 5W/23W, located 3,000-4,300 ft. west of existing Runway 5L/23R, is planned for the future (beyond 2005). Also, a 1,500-ft. runway extension to the south end of existing Runway 5R/23L is planned following the construction of the new runway. This would bring the total useable length for landings and take-offs to 9,000 ft.



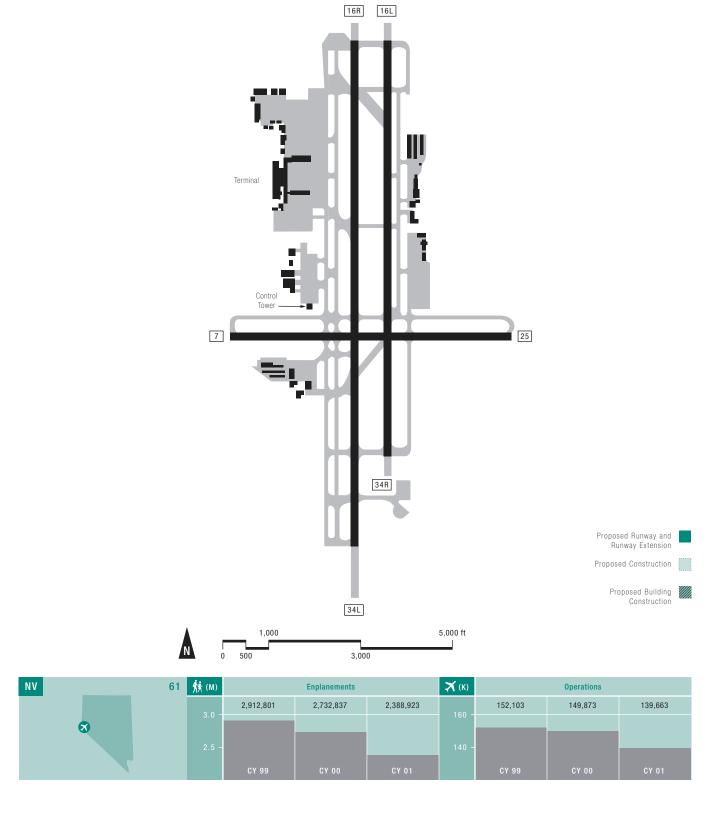
## RIC - Richmond International Airport

An extension of Runway 16/34 is under design. Construction has been delayed until after 2005.



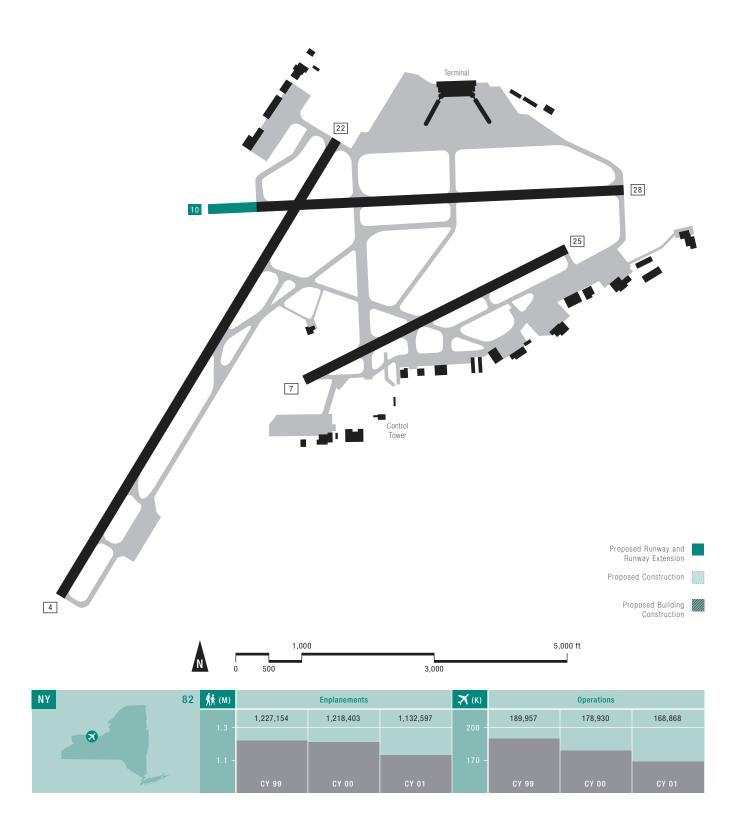
### RNO - Reno Tahoe International Airport

There are no new runway or runway extension projects planned, proposed, or currently under construction at this airport.



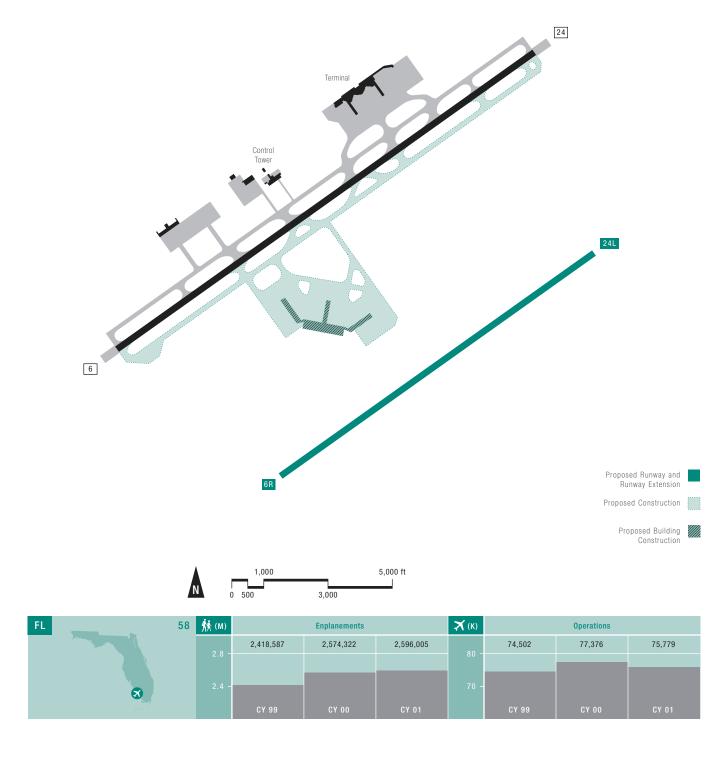
# ROC - Greater Rochester International Airport

There are no new runway or runway extension projects planned, proposed, or currently under construction at this airport.



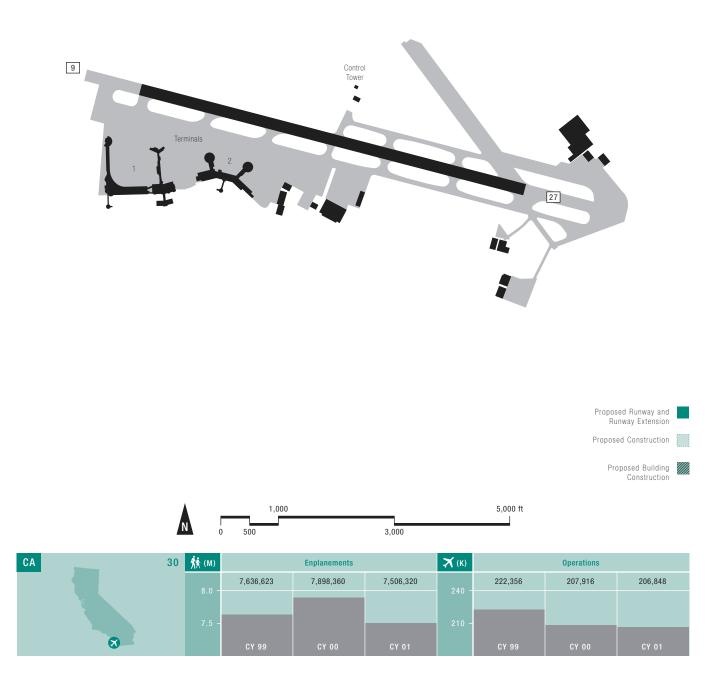
### RSW - Fort Myers Southwest Florida Regional Airport

Planning has begun for a new 9,100 ft. parallel Runway 6R/24L, 4,300 ft. or more southeast of Runway 6/24. Construction is expected to begin in 2008. The new runway should be operational by 2010. The estimated cost of the project is \$80 million. This new runway will support independent parallel operations. A new terminal complex is planned to be located between the parallel runways. It is expected to be operational by 2005.



### SAN - San Diego International Lindberg Field

There are no new runway or runway extension projects planned, proposed, or currently under construction at this airport.



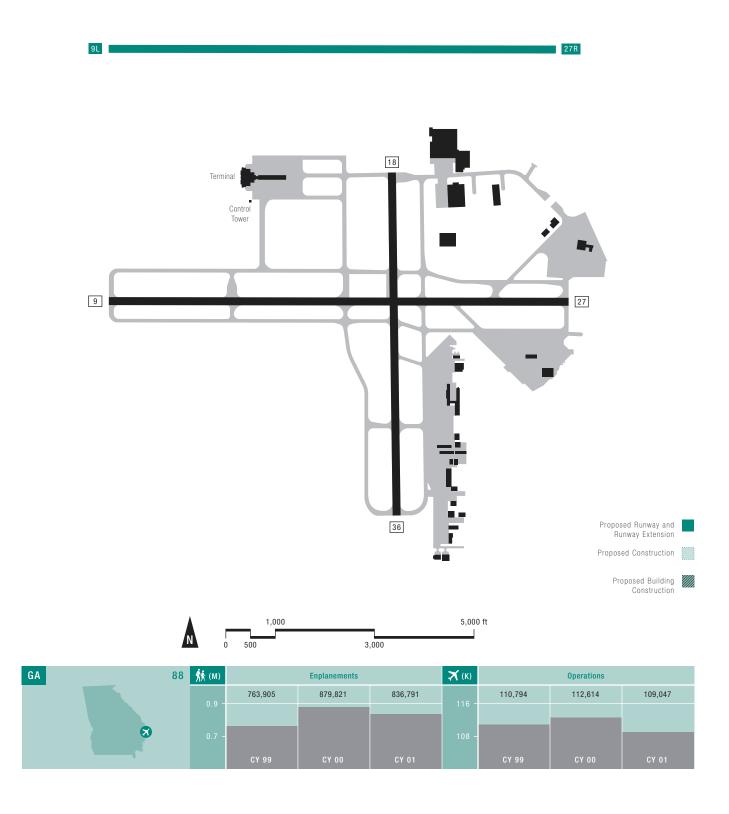
### SAT - San Antonio International Airport

Reconstruction and extension of 12L/30R for air carrier operations is planned for completion by 2006. A third parallel runway, Runway 12N/30N, is in the long term planning, within 5-10 years. Taxiway and cargo ramp expansion were completed in 2000. Expansion of the terminal to 29 gates is planned for 2002.



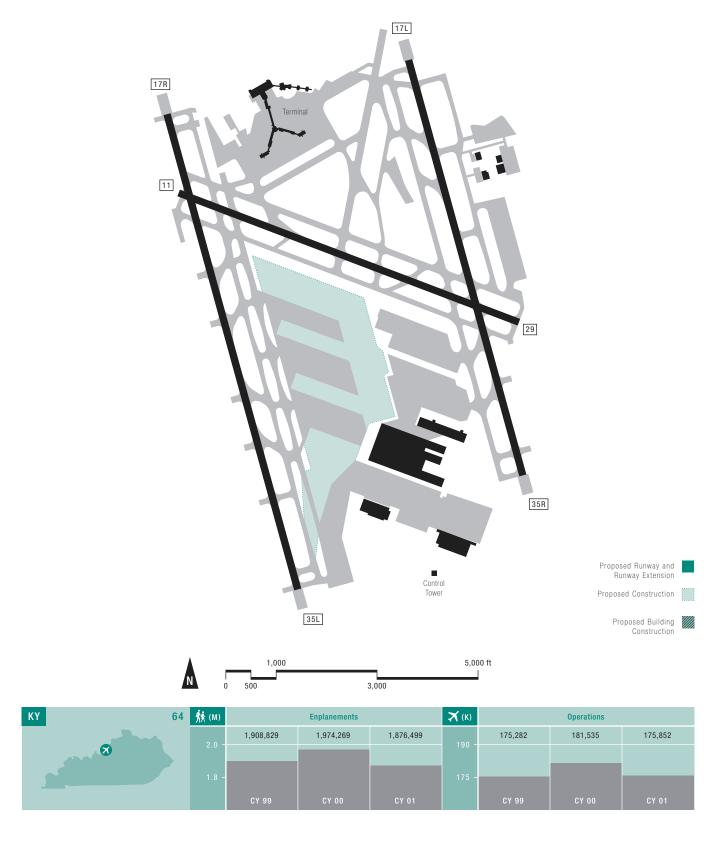
### SAV - Savannah International Airport

A new 9,000 ft. parallel Runway 9L/27R, approximately 5,000 ft. north of Runway 9/27, is expected to be constructed by 2020, with an estimated cost of \$20 million. This runway would allow independent parallel operations, thereby potentially doubling hourly capacity.



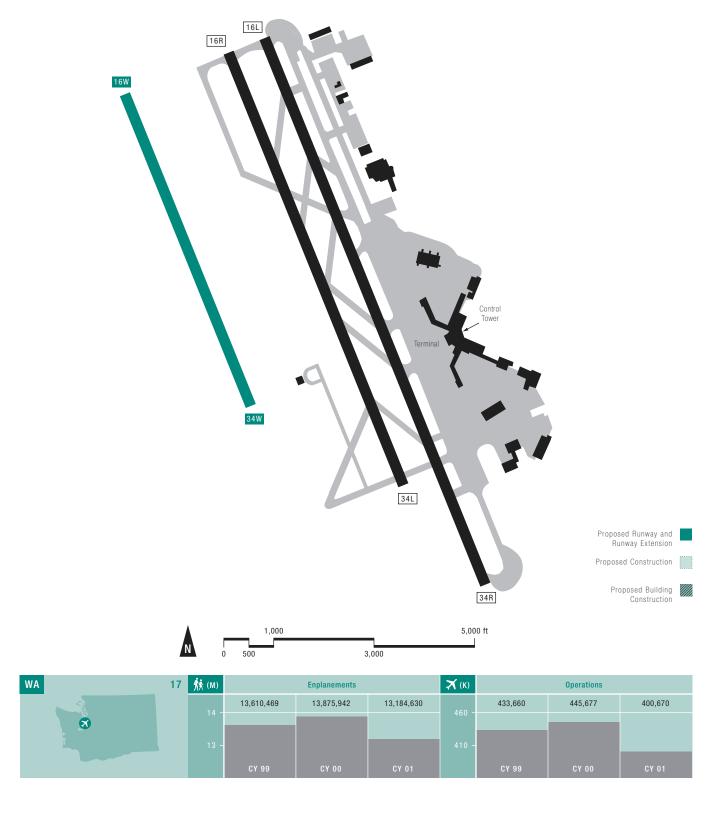
### SDF - Louisville International Airport

A runup pad at the south end and west of runway 17R-35L is proposed for construction in the year 2003 at a cost of \$5 million. The extension of runway 17R-35L is presently under review. The cost and date of construction is yet to be determined.



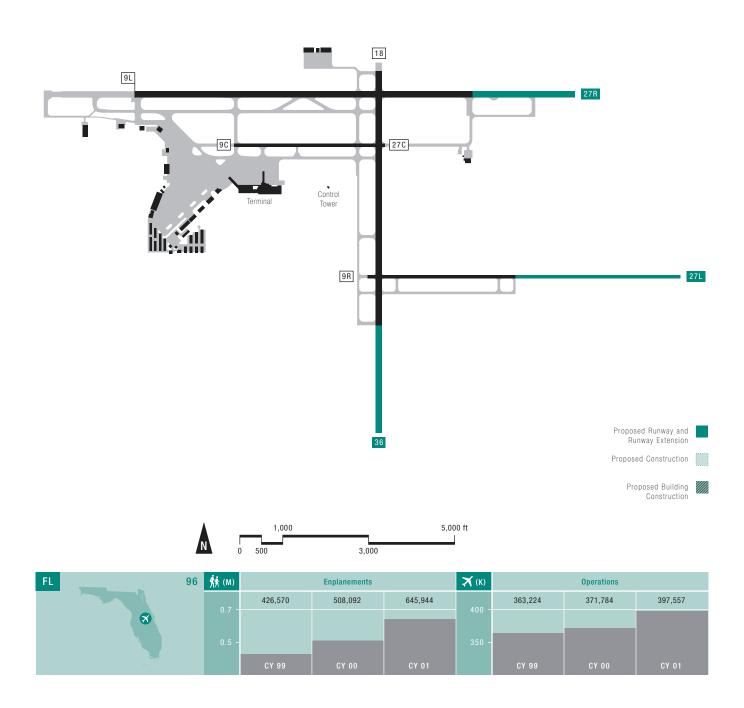
### SEA - Seattle-Tacoma International Airport

Airport improvements include a new Runway 16W/34W, 8,500 ft. in length, which will be located 2,500 ft. from Runway 16L/34R. Construction began in 1999. The runway will be completed by 2006 at a cost of \$773.0 million.



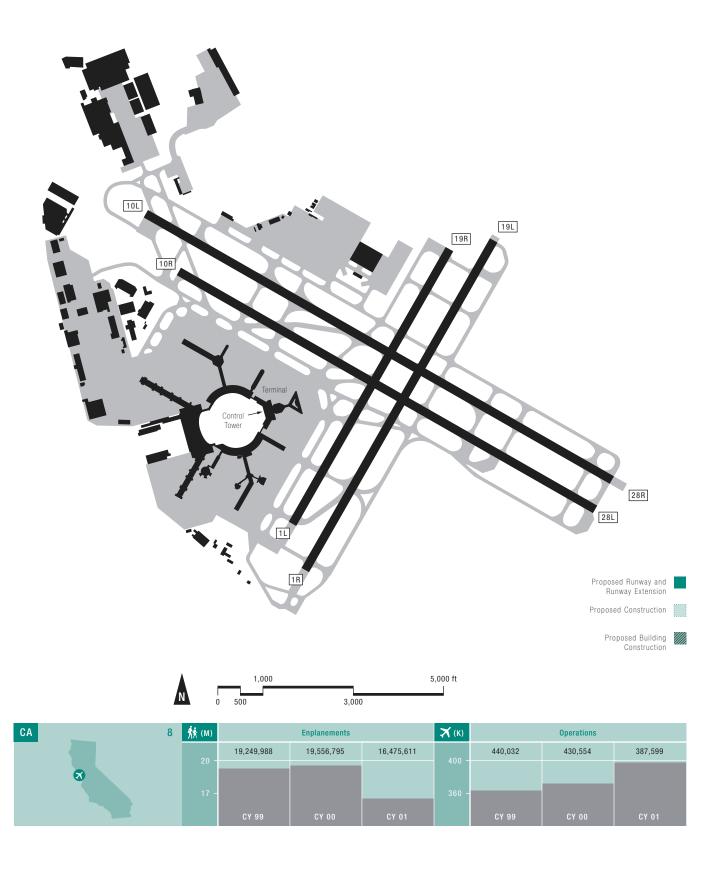
### SFB - Orlando-Sanford Airport

Runway 9C/27C, completed in 1998 at a cost of \$6.5 million, was approved for permanent use in 2001 by the FAA, following completion of an Environmental Assessment. Future plans include extending Runway 9R/27L to 7,400 ft. for completion by 2005 at an estimated cost of \$14 million, and then reconstructing this runway by 2006 at an estimated cost of \$4 million. Long term plans include extending Runway 18/36 to 8,500 ft., for completion by 2007 at an estimated cost of \$6 million, and extending 9L/27R to 12,000 ft. beyond 2007.



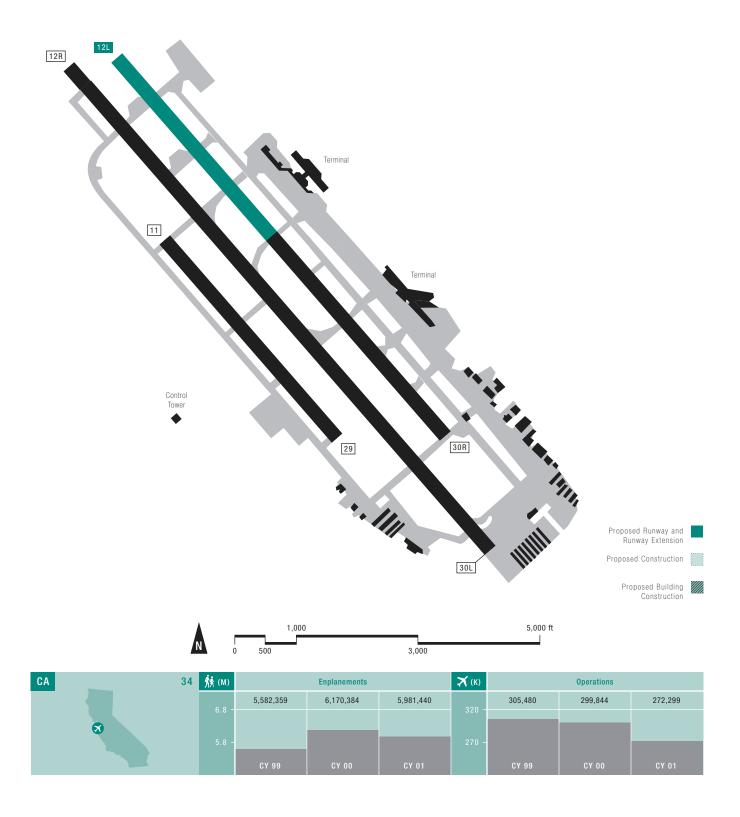
## SFO - San Francisco International Airport

There are no new runway or runway extension projects planned, proposed, or currently under construction at this airport.



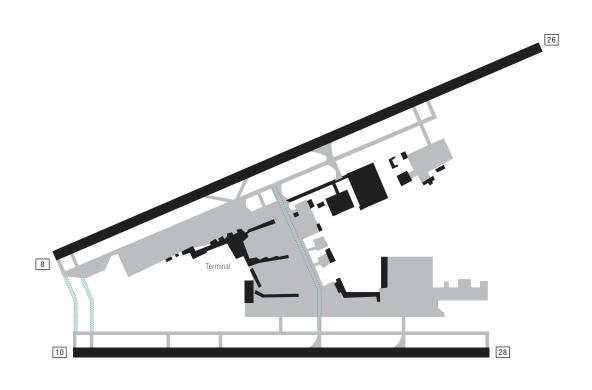
## SJC - Norman Y. Mineta San José International Airport

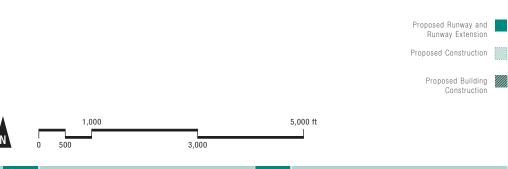
Extension, widening and strengthening of Runway 12L/30R was completed in August 2001 at a cost of \$65 million. Reconstruction of Runway 12R/30L was completed in 2002, and the lengthening of the runway from 10,200 ft. to 11,000 ft. is planned for 2003. The estimated cost is \$61.4 million.



# SJU - San Juan Luis Muñoz Marín International Airport

There are no new runway or runway extension projects planned, proposed, or currently under construction at this airport.

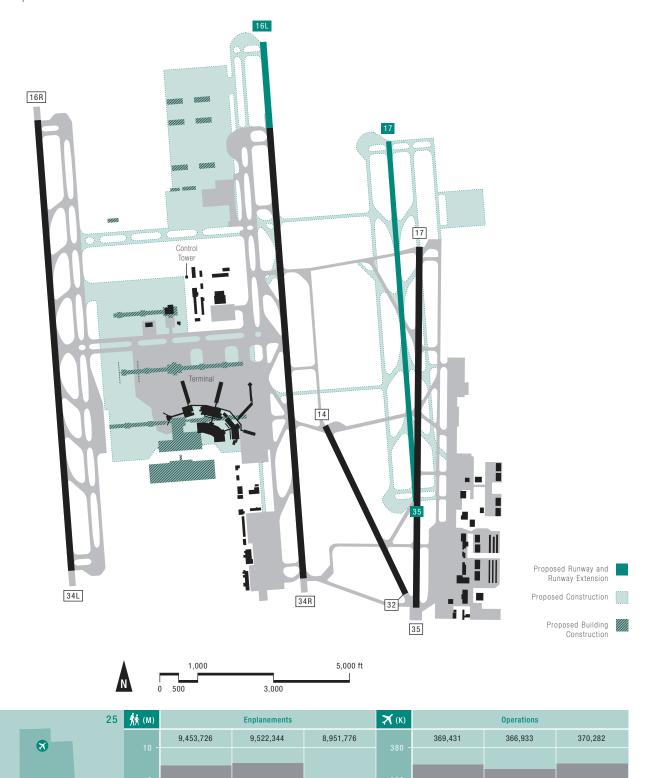




PR	41	<b>捺</b> (M)	Enplanements			<b>≯</b> (K)	Operations		
		5.2 -	4,760,643	5,135,591	4,706,307	240 -	224,133	236,903	205,976
	<b>3</b>					240 -			
		4.7 -							
			CY 99	CY 00	CY 01		CY 99	CY 00	CY 01

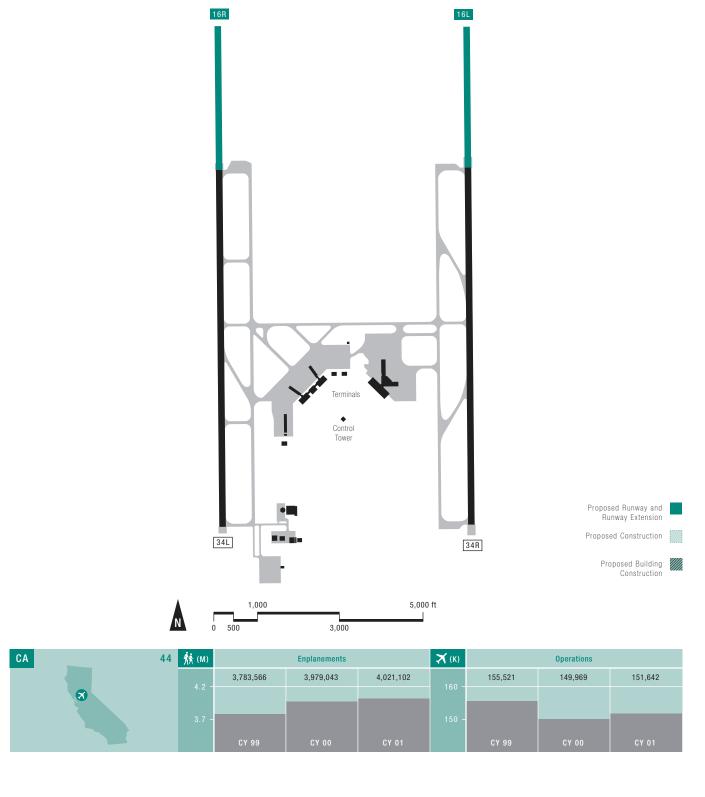
## SLC - Salt Lake City International Airport

In the long-term Runway 17/35 is planned to be realigned parallel with the other two major runways. This project is identified in the 20-year master plan update.



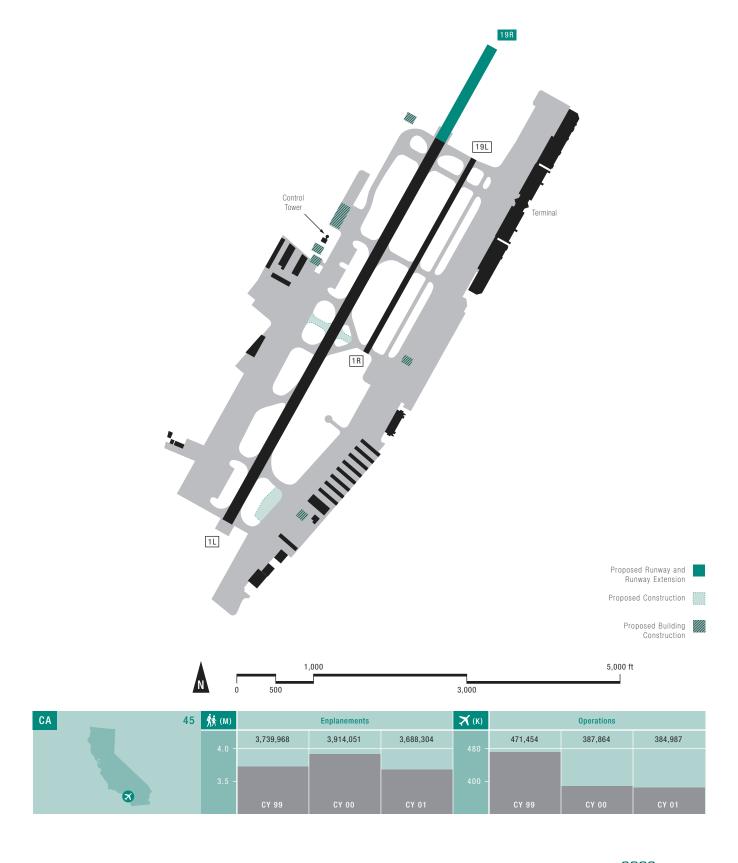
## SMF - Sacramento International Airport

A master plan update is currently in progress. A time frame for the proposed northerly extensions of Runway 16L/34R, to an ultimate length of 12,000 ft., has not yet been identified. Alternatives for the development of a third parallel runway are being considered. A third runway would not be required until beyond 2015.



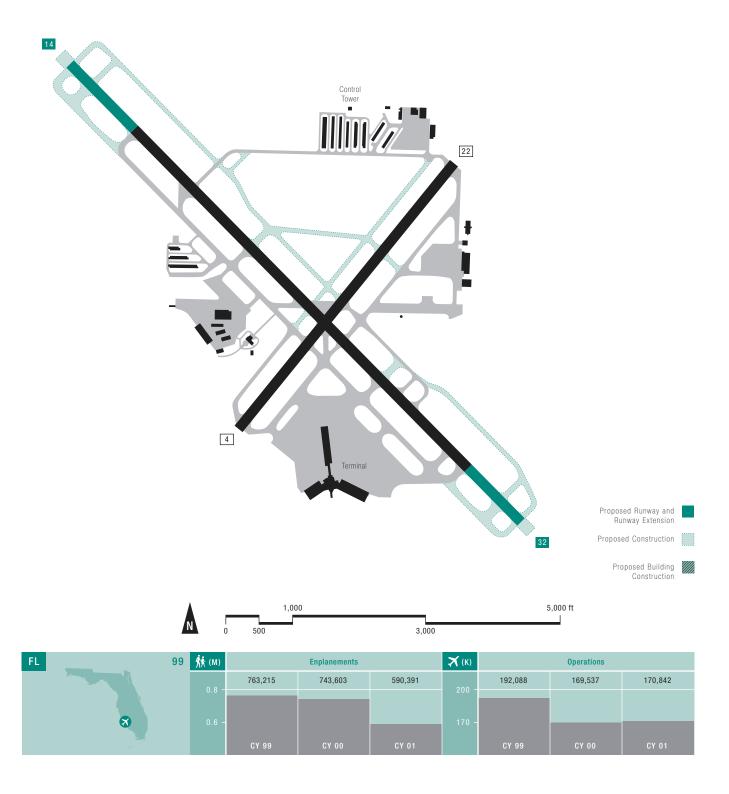
## SNA - John Wayne Airport - Orange County

An extension of Runway 1L/19R has been considered, but is not included in Orange County's current airport development plans.



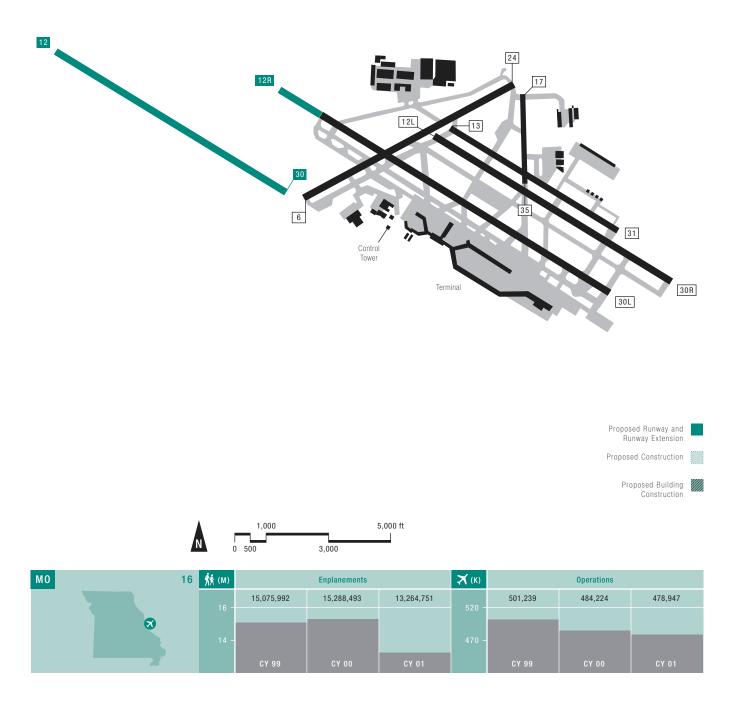
## SRQ - Sarasota Bradenton Airport

Two new parallel taxiways are being developed east of Runway 14/32 (Charlie Taxiway) and north Runway 4/22 (Delta Taxiway), as are additional runway exits suited to G.A. operations. The new parallel taxiways will reduce occupancy time and separate ground taxi operations between air carriers and G.A. The cost of these taxiways is estimated at \$12.5 million and will be operational by 2004. In addition, an extension of the existing Runway 14/32 is planned at a cost of \$5.1 million. It is expected to be operational in 2002. The runway extension will allow departures by larger and heavier aircraft and by aircraft with longer haul-lengths.



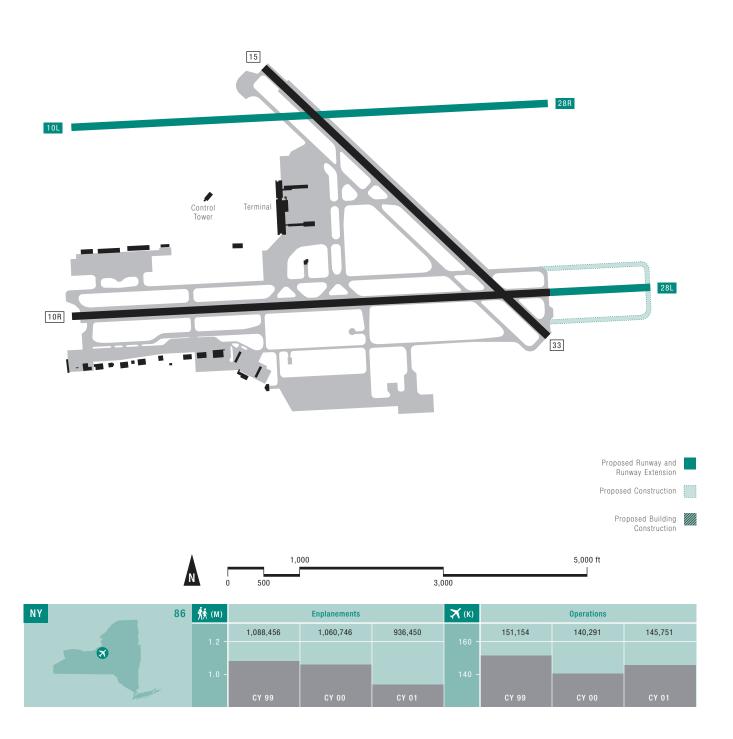
## STL - Lambert St. Louis International Airport

A new parallel Runway 12R/30L has been recommended in the St. Louis Airport Master Plan Update. The Plan calls for a parallel runway supporting independent IFR arrivals. Construction is in progress with an estimated completion date of 2006.



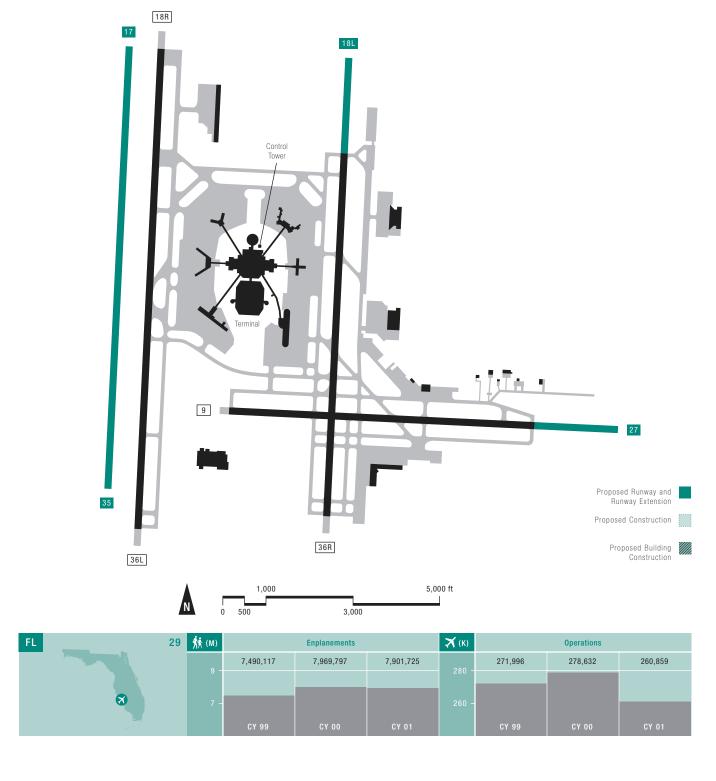
## SYR - Syracuse Hancock International Airport

A new parallel Runway 10L/28R, 9,000 ft. long and separated from the existing Runway 10/28 by 3,400 ft. is being considered. It would provide independent parallel IFR operations, doubling hourly IFR arrival capacity. The cost of construction is estimated to be \$55 million for the first phase of the new runway, which would be 7,500 ft. long, including a parallel taxiway and connections to the ramp. The final length of the runway would be 9,000 ft. A capacity analysis and needs study is presently underway. Runway 10R/28L is planned to be extended 2,000 ft. to an ultimate length of 11,000 ft.



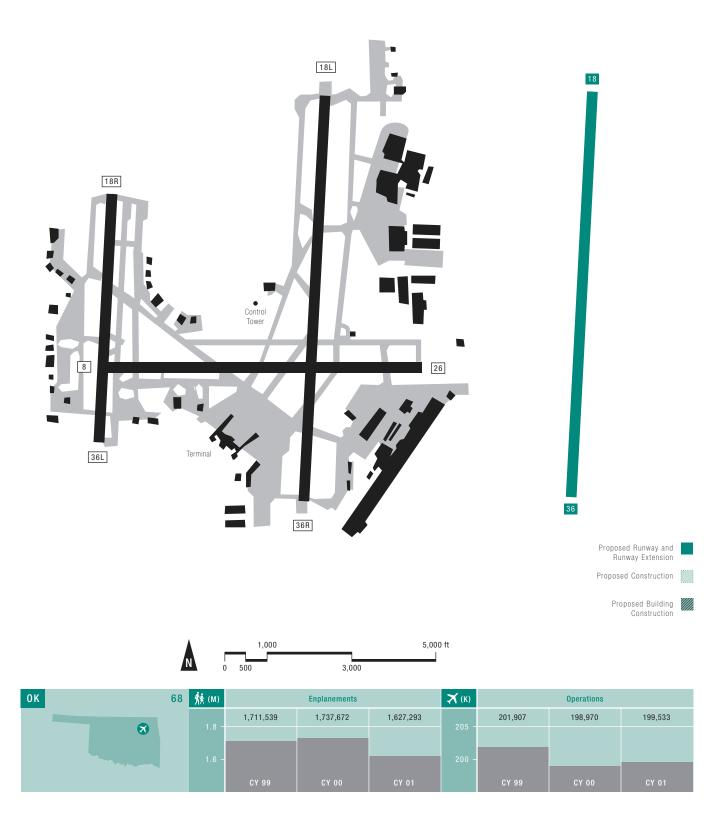
## TPA - Tampa International Airport

A third parallel Runway 17/35 is being considered for construction in 2010, with an operational date of 2012. It will be located 700 ft. west of the centerline of existing Runway 18R/36L, and will be approximately 10,160 ft. in length. Prior to the construction of this new runway, it is anticipated that Runway 18R will be upgraded to CAT II/III, and the associated ILS will be relocated to the new runway before it becomes operational. It is anticipated that Runway 18L will also be upgraded to CAT II/III capabilities to permit south flow landings below CAT I minimums. In addition, a 2,200-ft. northern extension of Runway 18L and a 1,200 ft. eastern extension of Runway 27 are being considered for the time frame beyond 2020.



## TUL - Tulsa International Airport

A new parallel Runway 18/36, located 6,400 ft. east of the present 18L/36R and 9,000 ft. long, is being considered. The new runway would permit IFR triple independent approaches, if approved, to Runways 18L, 18C, and 18R. It is estimated to cost \$115 million and will be operational in 2010.



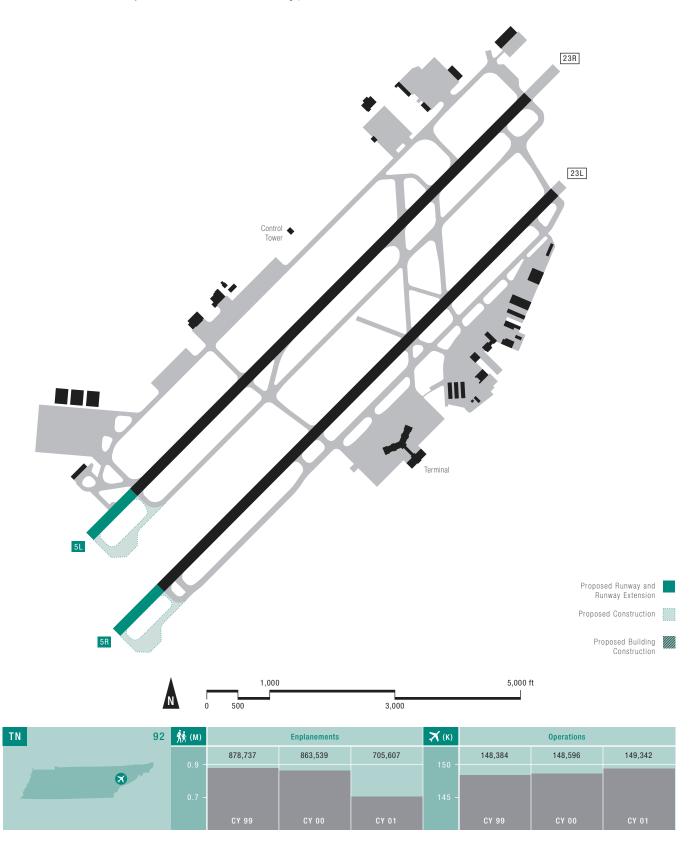
## TUS - Tucson International Airport

An additional parallel air carrier Runway 11R/29L has been proposed. Upon completion of the new runway, the current Runway 11R/29L, a general aviation runway, will revert to its original taxiway status. Current plans call for construction to start in 2008 to be operational in 2010. The estimated is \$50 million.



# TYS - Knoxville McGhee-Tyson Airport

An extension of both runways, 5L/23R and 5R/23L, is being planned for the future.





ACE Aviation Capacity Enhancement
ADA Airline Deregulation Act of 1993

ADS-B Automatic Dependent Surveillance Broadcast

ADSIM Airfield Delay Simulation Model

AGL Above Ground Level

AIP Airport Improvement Program

AIR-21 Wendell H. Ford Aviation Investment and Reform Act

for the 21st Century

ALP Airport Layout Plan

ARTCCs Air Route Traffic Control Centers
ARTS Automated Radar Terminal Systems

ASC Office of System Capacity

ASPM Aviation System Performance Metrics

ATA Air Transport Association
ATCT Air Traffic Control Towers

ATCSCC Air Traffic Control System Command Center,

also known as Command Center

BPI Best Practices Information

BTS Bureau of Transportation Statistics

CAA Cargo Airline Association

CCFP Collaborative Convective Forecast
CDM Collaborative Decision Making
CDPs

CDRs Coded Departure Routes

**CDTI** Cockpit Display of Traffic Information

CEP Capacity Enhancement Plan
CFIT Controlled Flight Into Terrain
CIP Capital Investment Plan

CIWS Corridor Integrated Weather System

CPDLC Controller Pilot Data Link Communication

CY Calendar Year

DME Distance Measuring Equipment
U.S. Department of Defense
U.S. Department of Transportation

**DPs** Departure Procedures

**DRVSM** Domestic Reduced Vertical Separation Minima

**DSR** Display System Replacement

**DUATS** Direct User Access Terminal Service

**EAS** Essential Air Service

EIS Environmental Impact Study

ERAM En Route Automation Modernization
ETMS Enhanced Traffic Management System

FAA Federal Aviation Administration

FFP1 Free Flight Phase 1
FIS Flight Information Service

FL flight level

FMS Flight Management System

FY Fiscal Year

GA General Aviation

GARBs General Airport Revenue Bonds

GPRA Government Performance Results Act of 1993

GPS Global Positioning System

GRADE Graphical Airspace Design Environment

IFRInstrument Flight RuleILSInstrument Landing SystemLAASLocal Area Augmentation System

LDA Localizer Directional Aid

LOI Lateral Navigation
LOI Letter of Intent

LPV Lateral with Precise Verticals

MAMS Military Airspace Management System

MAP Military Airport Program
MOA Military Operations Area

MSL Mean Sea Level

NAR National Airspace Redesign
NAS National Airspace System

NASA National Aeronautics and Space Administration

NCT Northern California TRACON

**NLA** New Large Aircraft

NORAD Northeast Air Defense Sector

NPIAS National Plan of Integrated Airport Systems

NTSB National Transportation Safety Board
NYICC New York Integrated Control Complex

**OEP** Operational Evolution Plan

OOOI Out, Off, On and In

**OPSNET** FAA's Operations Network

PAPI Precision Approach Path Indicator

PARR Problems Analysis, Resolution and Ranking

PCT Potomac Consolidated TRACON

PDARS Performance Data Analysis and Reporting System

PFCs Passenger Facility Charges
PRM Precision Runway Monitor

**REIT** Runway End Identification Lights

RJs Regional Jets

RMT Route Management Tool
RNAV Advanced Area Navigation

**RNP** Required Navigational Performance

RTMs Revenue Ton-Miles
RVR Runway Visual Range

**RVSM** Reduced Vertical Separation Minima

SAMS Special Use Airspace Management System

SIMMOD Simulation Model

SMA Surface Movement Advisor

SOIA Simultaneous Offset Instrument Approaches

STARs Standard Terminal Arrival Routes

SUA Special Use Airspace

TCAS Traffic Collision Avoidance System

TMA Traffic Management Advisor

TIS-B Traffic Information System Broadcast
TRACON Terminal Radar Approach Control facility
TSA Transportation Security Administration

**URET** User Request Evaluation Tool

VACAPES Virginia Military Capes
VFR Visual Flight Rule
VNAV Vertical Navigation

VOR very high frequency omnidirectional range

WAAS Wide Area Augmentation System
WATRS West Atlantic Route System



#### Air Traffic Control

A service operated by appropriate authority to promote the safe, orderly and expeditious flow of air traffic.

#### Air Route Traffic Control Center

A facility established to provide air traffic control service to aircraft operating on IFR flight plans within controlled airspace and principally during the en route phase of flight.

#### Airway

A Class E airspace area established in the form of a corridor. The centerline of which is defined by radio navigation aids.

### Approach Gate

An imaginary point used within ATC as a basis for vectoring aircraft to the final approach course.

## Area Navigation

A method of navigation that permits aircraft operations on any desired course within the coverage of station-referenced navigation signals or within the limits of self-contained system capability.

## Category I (CAT I) Precision Approach

A precision approach that provides for approach to a height above touchdown of not less than 200 feet and with runway visual range of not less than 2,400 feet.

## Category II (CAT II) Precision Approach

A precision approach that provides for approach to a height above touchdown of not less than 100 feet and with runway visual range of not less than 1.200 feet.

### Category III (CAT III) Precision Approach

A precision approach that provides for approach without a decision height minimum and with runway visual range from 700 feet to none.

### Close Parallel Runways

Two parallel runways whose extended centerlines are separated by less than 4,300 feet.

## Controlled Airspace

An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights.

### Data Link

A digital communications system that can transmit data from a controller to an aircraft and vice versa.

#### Departure Procedure

A charted IFR departure procedure.

## Distance Measuring Equipment

Ground and airborne equipment designed to measure (in nautical miles) the distance of an aircraft from a navigational aid such as a VOR, VORTAC, OR, TACAN.

#### Fix

A geographical position determined by visual reference to the surface, by reference to one or more navaids, by celestial plotting, or by another navigational device.

## Flight Level

A level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury. Each is stated in three digits that represent hundreds of feet. For example, flight level 250 represents a barometric altimeter indication of 25,000 feet.

## Flight Management System

A computer system that uses a large data base to allow routes to be programmed and fed into the system, which is constantly updated with respect to position accuracy by reference to conventional navigation aids.

#### Flow Control

Measures designed to adjust the flow of traffic into a given airspace, along a given route, or bound for a given airport so as to ensure the most effective utilization of the airspace.

## Glideslope

Provides vertical guidance for aircraft during approach and landing.

## Global Positioning System

A space-based radio positioning, navigation and time-transfer system, which provides highly accurate position and velocity information, and precise time, on a continuous global basis.

#### Ground Delay

The amount of delay attributed to air traffic control, encountered prior to departure.

### **Ground Stop**

Normally, the last initiative to be utilized; this method mandates that the terminal facility will not allow any departures to enter center airspace until further notified.

#### Handoff

The action taken to transfer the radar identification of an aircraft from one controller to another when the aircraft will enter the receiving controller's airspace and radio communications will be transferred.

### **Hold Procedures**

A predetermined maneuver that keeps aircraft within a specified airspace while awaiting further clearance from air traffic control.

#### Instrument Flight Rules

Rules governing procedures for conducting instrument flight.

## Instrument Landing System

A precision approach and landing aid that normally consists of a localizer, a glideslope, marker beacons, and an approach light system.

### Integrity

The ability of a system to provide timely warnings to users when the system should not be used for navigation.

### Lateral Navigation

A function of area navigation that calculates, displays, and provides lateral guidance to a profile or path.

#### Miles-in-Trail

A specified distance between aircraft, normally in the same stratum associated with the same destination or route of flight.

### National Airspace System

The common network of U.S. airspace; air navigation facilities, equipment and services; airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

# Navigational Aid

Any visual or electronic device, airborne or on the surface, that provides point-to-point guidance information or position data to aircraft in flight.

### Nonprecision Approach

A standard instrument approach in which no electronic guide slope is provided.

## Parallel Runways

Two or more runways at the same airport whose centerlines are parallel.

### Precision Runway Monitor

Provides air traffic controllers with high precision secondary surveillance radar for aircraft on final approach to parallel runways that have extended centerlines separated by less than 4,300 feet.

### Precision Approach

A standard instrument approach in which a course and glideslope/glidepath are provided.

## Radio Altimeter

Aircraft equipment that makes use of the reflection of radio waves from the ground to determine the height of the aircraft above the surface.

# Reliever Airport

A general aviation airport designated to provide an alternative to commercial service airports in major metropolitan areas.

### Required Navigation Performance

A statement of the navigation performance accuracy necessary for operation within a defined airspace, including the operating parameters of the navigation systems used within that airspace.

#### Sector or Control Sector

An airspace area of defined horizontal and vertical dimensions for which a controller or group of controllers has air traffic control responsibility, normally within a center or terminal area.

### Separation

In air traffic control, the spacing of aircraft to achieve their safe and orderly movement in flight and while landing and taking off.

#### Standard Terminal Arrival

A pre-planned instrument flight rule air traffic control arrival procedure published for pilot use in graphic and/or textural form. STARs provide transition form the en route structure to an outer fix or an instrument approach fix/arrival waypoint in the terminal area.

### Threshold

The beginning of that portion of the runway useable for landing.

## Traffic Management Unit

The entity in ARTCCs and designated terminals responsible for direct involvement in the active management of travel.

#### Tower

A terminal facility that uses air/ground communications, visual signaling, and other devices to provide ATC services to aircraft operating in the vicinity of an airport or on the movement area.

#### **TRACON**

A terminal ATC facility that uses radar and nonradar capabilities to provide approach control services to aircraft arriving, departing, or transiting airspace controlled by the facility.

### Vertical Navigation

A function of area navigation that calculates, displays, and provides vertical guidance to a profile or path.

### Visual Flight Rules

Rules that govern the procedures for conducting flight under visual conditions.

#### Vortex or Wake Vortex

A circular pattern of air created by the movement of an airfoil through the air when generating lift.

# Waypoint

A predetermined geographical position used for route/instrument approach definition and other navigational purposes that is defined relative to a VORTAC station or in terms of latitude/longitude coordinates.



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